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*Some Notes on the History of Infant Feeding

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Following the custom of this Society, I have chosen for my topic a subject of historical interest relating to Pediatrics, viz., "The History of Infant Feeding."

It is a truism that a review of the past is of value in giving us a proper perspective of the present.

The history of infant feeding is only a small corner of a larger field of medical history but its importance will be hardly gainsaid.

Although both Hippocrates (460-370 B.C.) and Celsus (53 B.C.-A.D. 7) had shown in their writings that disease in the child differs from disease

in the adult and requires different treatment, and that the rearing of the infant with the troubles of dentition calls for special care, it was not until nearly a century afterwards, that the first treatise dealing especially with "Diseases of Children," was written by Soranus of Ephesus (A.D. 98-117).

The comprehensiveness of his treatise so far as infancy is concerned may be judged from a list of the subjects considered.

"On the care of the baby. How to know what is capable of being reared. How the cord is to be divided. How inunction is to be done. How swaddling should be done. On the baby's lying down. On feeding. On the choice of wet-nurse. On testing of milk. On the régime of the wet-nurse. What should be done if the milk dries up or becomes unwholesome or too thick or too thin. On the bathing and rubbing of the baby. How and when to give the breast to the baby. On the separation of the cord. When and how the baby should be freed (from its swaddling bands). How to practise it in sitting and walking. When and how to wean the baby. On teething. On apthae. On rashes and itchings. On wheezing and cough. On seiriasis. On flux of the belly."

Soranus is the first writer to mention the method of testing the breast milk by the behaviour of a drop of milk placed on one's finger-nail. This continued in use for over 1,600 years; the first book on diseases of children written in English, the work of Thomas Phaer in 1545, repeats it in words which correspond very closely to Soranus' original description; "That mylke is goode that is whyte and sweete; and when ye droppe it on your nayle and do move your finger, nyether fleteth abroad at every stiring nor will hange faste upon your naile when ye turne it downward, but that whyche is betwene bothe is beste." It is repeated even as late as 1752 in W. Smellie's Treatise on the theory and practice of Midwifery.

Twenty to thirty years after the death of Soranus, the city of Asia produced a physician in the person of Claudius Galen (A.D. 130-A.D. 200) who was to be second only to Hippocrates in fame.

There is no systematic account of Diseases of Children amongst Galen's writings, but he refers to particular affections of children incidentally.

His directions as to feeding I quote "She shall feed the child only on milk, but when he has cut his front teeth it is well to accustom him to more solid food, as women do of their own accord, having learnt this by experience."

More than a century elapsed after Galen before Oribasius (A.D. 325-403) works appeared.

It is recorded that Oribasius wrote a complete work on medicine in seventy books. In his treatise "On the Feeding of an Infant" concerning

* Address of the Retiring President of Winnipeg Medical Society, read May, 1936.

a wet nurse he has this to say "One should select a nurse who has no disease of any sort, not too young and not too old. The youngest should be 25 years old, the oldest 35 years, and she should have a broad chest, large breasts and nipples which are not shut off and retracted. The rest of her body should not be excessively fat nor over lean. It is a great thing for the child that the nurse should have been delivered not long ago and preferably of a male child. Let her avoid things that are particularly drying, and salt things, and things which are pungent and astringent, and sharp and bitter and very heating things, and those that have a particularly unpleasant odour and strong savours and seasoning and other pungent things. The nurse should also abstain from venery and should do work with the hands and shoulders, so she should grind and weave and walk about with the child in her arms. She should carry the infant in the arms up to the age of three or four months.

Of all the Arabian physicians, none was more famous than Avicenna (A.D. 980) and none more frequently quoted by early English writers on medicine.

Avicenna maintains, as do the other writers I have mentioned, that failing the mother the choice of a wet nurse is an essential part of the care of an infant. Avicenna like some of his predecessors considers that it will be more prudent at the start that some other woman and not the mother should suckle until the mother has been restored to her former condition.

One might almost think that Avicenna anticipated some of the endocrine follies of today, when he says: "Some have reported that the teats of sheep and goats, particularly, eaten with their milk in them, have a notable effect in producing milk, and this either on account of similarity of substance or of some obscure quality." The value of massage of the breasts is recognized; "Frequent squeezing of the breasts produces a flow of milk."

With reference galactagogues he says: "Others recommend a drachm of dried bore-worms or earth-worms in barley water, taken for several days, and say they have found it most efficient. A similar effect comes from the head of flying-fish steeped in Dill water. Among things which increase milk in this way; take an ounce of cow's milk butter, put it in a cyathus of undiluted wine and drink it; or take sesame ground in a mill, mix with wine, pour it through a sieve and drink."

From the time of the Arabian physicians until the Renaissance there was none that left a name behind him as a writer in Pediatrics.

It was not until the invention of printing in the middle of the 15th century, which replaced the laborious hand copying, and restricted the diffusion of knowledge that the revival of learning really began so far as medicine is concerned.

So far as England is concerned the subject seems to have been in abeyance. In the 200 years following the invention of printing, i.e. up to 1650, there were only two English writers on Diseases of Children, Phaer and Whistler, and the latter only dealt with a particular disease, viz., Rickets.

Thomas Phaer, the father of English Pediatrics, 1510-1560, was born in Norwich. He was educated at Oxford and went thence to Lincoln Inn where he read law and attained a considerable knowledge in the municipal laws.

Phaer's "Booke of Children" was published in 1545. It was printed along with his translation from the French of the "Regimen sanitatis salerni," which Phaer entitled the "Regiment of Life," and "a goodly Bryefe Treatise of the Pestylence with the causes, signs and the cure of same" and "Declaration of the Veynes of Man's Body, and to what Dyseases and Infirmities the opening of every one of them does serve."

Phaer has many quaint remarks on infant feeding, but does not speak of any artificial means. He sums up the whole subject which to him lay between mother and wet nurse in the following words "Wherefore as it is agreing to nature, so is it also necessary and comly for the own mother to nurse the own child. Whiche if it maye be done, it shal be most cemendable and holsome, if not ye must be well advised in taking of a nource, not of yll complexion and of worse maners: but such as shal be sobre, honeste and chaste, well fourmed, amyable and chearefull, so that she may accustome the infant unto myrth, no dronkard, vycyous nor sluttyshe, for suche corruptethe the nature of the chylde.

But an honest woman (suche as had a man chylde last afore), is best not within two monethes after her delyveraunce, nor approchyng nere unto her time againe. These things oughte to be cosidred of every wyse person, that wyll set theyr children out to nource. Moreover, it is good to loke upon the milke, and to se whether it be thicke & grosse, or to moch thinne and watrye, blackyshe or blewe, or enclynyng to rednesse or yelow, for all suche are unnaturall and evyll. Likewise when ye taste it in your mouthe, yf it be eyther bytter, salte, or soure, ye may wel perceyve it is unholosome."

He then quotes the nail test of Soranus, for the analysis of a perfect milk from a wet nurse.

Simon de Vallambert about 1565, was born at Avalon in Burgundy. He produced the first Pediatric work in French entitled "On the Feeding and Management of Children from their Birth."

He writes as much for nurses and midwives as for medical men. He says that "because the majority of these (midwives and nurses) are ignorant, I have undertaken the writing of this instruction to teach them, for what moved me to do so is a desire to be heard by the women of France. In any other medical matter which

belonged only to the cognisance of doctors I could not have ventured in this public way, because no one can rightly understand medicine, nor should adventure himself into the handling of it, except he be instructed and skilled in those languages which were written by the ancients and the earliest physicians. It is not a good thing that at the present time so many persons meddle with turning into French and publishing Galen, Dioscorides, and some of the handbooks of modern doctors with the object of giving them to be perused by rude and ignorant persons who abuse medicine: this is a matter with pernicious result and ought to be prohibited by Royal edict."

May not Vallambert be the originator of the prevailing idea in Public Health departments, that as soon as a baby is born, the mother should be inundated with literature, books, etc., on the care and feeding of children, and should be guided in these directions by a Public Health nurse.

His chapter on the feeding of the infant up to the time of weaning is by far the best that had been written up to that time. Weaning in those days was done at the age of eighteen months or two years, and it was customary to give other food in addition to the breast milk from the age of three months or even earlier, and he discusses the suitability of the various foods. He says that one of the first foods added was usually cow's milk or goat's milk (the latter he considers the more suitable), with semolina or flour or crumbled white bread boiled in it, sometimes with the addition of yolk of egg. He makes the first mention of a baby-feeding apparatus—"a horb with an opening at both ends, one end being made into the shape of a teat, through which the infant sucks the pap just as it sucks breast milk by the nipple."

Writer after writer had handed on the unwholesome advice of Avicenna that the nurse before giving bread or other solid food to the infant should chew it thoroughly in her own mouth, and then spue it, and put in with her fingers, into the infant's mouth. De Vallambert attacks this custom on several grounds. He says that under various conditions the saliva of a person may be poisonous to the infant. He thinks that food thus chewed by another may give rise to worms, and in any case the saliva of the individual has properties which make it suitable to him and not to another. So he condemns this practice; and he goes further with the logical conclusion that even to drink out of the same glass or cup as another person is unhealthy.

De Vallambert's chapter is full of sound practical observation on the connexion between faulty feeding and wasting, and he recommends goat's milk, almond-milk, blanchmange, sweetened broth, and the use of nutrient enemata (not mentioned by any previous writer on children); he explains that these are of value for nutrition because the food is taken up by the mesenteric veins which lead to the liver.

The seventeenth century saw no contribution by any English writer to the subject of Diseases of Children until 1645 when Daniel Whistler (1619-1684) published the first detailed description of rickets.

Some five years later Francis Glisson in 1597-1677 published a more detailed account of rickets with diagnosis, illustrating the explanation of knock-knee and the deformity of the chest in rickets with diagrams.

Thomas Sydenham (1624-1689) made his name memorable in connexion with children's diseases, as the term "Sydenham's Chorea" still testifies, but little is known that he also made the original most minute and careful description of measles. His account of Scarlet Fever (1675) is less detailed, and strangely enough Sydenham usually an accurate observer, makes no mention of a sore throat.

Contemporary with Sydenham was another distinguished physician Thomas Willis (1621-1675) best known as an anatomist, especially for his work on the anatomy of the brain—still remembered as "the circle of Willis." Willis deals with epilepsy, and its treatment with frequent reference to children.

In 1689, there was published in London a little treatise, "De Morbis Acutis Infantum," which Still says attained a reputation far beyond its merits and was quoted for a least one hundred years. The author was Walter Harris.

His hypothesis was "The Antecedent and more distant Causes of the Diseases of Infants, however numerous or various they may be, all centre at last, in one immediate Cause, viz., in an acid prevailing through the whole habit."

Nay, the apparent variety of diseases in infants was itself mere fallacy, it was variation in degree, not in kind; "I make no scruple to assert that the Diseases of Infancy are very few in their kind, and differ only in Degree from one another" . . . "In short," he says, "all the complaints of Infants spring from an Acid as their Common Source." The curdled milk, the sour breath, the acid smelling stools, the excoriation by the urine, all this was surely proof enough that the fons et origo of infantile disorders was acidity.

The treatment was correspondingly simple, some form of calcium carbonate must be given to neutralize the acid, which is then to be expelled by an aperient.

Ruhrah comments as follows with reference Harris' theory of acidity "and what is acidosis." We present day moderns are too prone to the vulgar error that our own opinions are new and original. As a matter of fact for the most part they are neither. Ideas do not die. They fall asleep, perhaps for centuries, and then come to life often simultaneously in several different places.

If one is interested he should read Harris' absolutely accurate description of what we today call acute gastro-intestinal intoxication.

His statement about the seasonal appearance of diarrhoea is equally true today—"From the middle of July to about the middle of September, the Epidemical Gripes of Children are so rife every year, that more of them usually die in one month, than in three or four at any other time: For the heat of that season commonly weakens them at least, if it does not entirely exhaust their strength."

Harris knew full well the importance of correct diet in early infancy and cautions against errors in this regard. He condemned the use of flesh in infancy, and stated the results of this regimen are almost inseparable from the over-feeding or underfed infants.

Harris today might be classed in the category of good salesman, in that he changed his religion from Protestant to Catholic and again back to Protestant.

The last writer on diseases of children in seventeenth century was John Pechey (1655-1716).

Pechey has much to say about the general upbringing of children and the responsibilities of parents.

In his chapter "Of Children's Wasting," after mentioning faulty breast milk as a cause, he says: "The blood should be generated and transmitted thro' the veins to the whole body, yet if there are worms in the back, arms, legs, and almost over the whole body, and there are so sometimes, the nourishment will be devoured by them. These worms are very small and are bred in the skin, and the heads of them appear like black hairs, upon friction in a bath; they are generated by vicious matter shut up in the capillary veins turned into worms, when transpiration is hindered."

This curious description appears with slight variations in several earlier writers. Pechey was no original observer. He was to repeat what others have said before him, "a la the writer."

It will be seen that the English writers on Pediatrics during the seventeenth century concentrated more on special diseases of children than on their feeding.

Rickets, chorea, scarlet fever and whooping cough were now recognized as diseases sui generis.

The beginning of the eighteenth century saw the introduction into England of the first steps in preventive medicine, not only as far as vaccination against smallpox is concerned, but as regards infant feeding and hygiene.

In 1729 a student at Leyden, Richard Conyers then twenty-two years of age, read a thesis in Latin, "De Morbis Infantum" for the degree of Doctor of Medicine.

Conyers returned to England and became physician to the Foundling Hospital in London which was opened in 1739.

In 1748 an essay by an anonymous writer on

the nursing of children was addressed to the Governors of the Foundling Hospital in which were advocated methods which Conyers himself advised 20 years earlier in his graduation thesis. To establish his priority Conyers decided to republish his dissertation.

Richard Conyers must have the credit of being one of the earliest to recognize that the traditional methods of feeding were wrong. From the day of birth infants were given pap, which was often just flour mixed with milk and water, making a sticky paste, which Conyers says might be much more usefully employed by bookbinders in sticking pages together than given to infants as nourishment. He protested also against the practice of chewing pap before giving it to the infant: he recognized that infection might be conveyed by it.

The writer of the anonymous article entitled "An Essay upon the Management of Children from Their Birth to Three Years of Age" was William Cadogan of Bristol (1711-1797), of which nine editions appeared in 20 years.

He hopes that the Foundling Hospital may be a means of introducing more rational methods: the ignorant still follow the example and transmitted customs of their great grandmothers; and if any one wants proof of the faulty character of the present mode of managing children let him "look over the Bills of Mortality, there he may observe that almost half the number of those that fill up the black list are under five years of age."

Cadogan was the first to raise his voice against the overclothing of the infant, so generally prevalent in his time. "The first great mistake is that they think a new-born infant cannot be kept too warm; from this prejudice they load it and bind it with flannels, wrappers, swathes, stays, etc., commonly called cloaths, which all together are almost equal to its own weight (he advises light loose garments, which he thinks) would be abundantly sufficient for the day, laying aside all those swathes, bandages, stays and contrivances, that are most ridiculously used to close and keep the head in its place and support the body, as if nature, exact nature, had produced her chief work, a human creature, so carelessly unfinished as to want those idle aids to make it perfect. Shoes and stockings are very needless incubrances, besides that they keep the legs wet and nasty if they are not changed every hour."

Cadogan advocated that nothing should be given to the infant until it was put to the breast six or seven hours after delivery. He advocates feeding from both breasts at a feed. "Four times in 24 hours will be often enough to give it suck, letting it have as much as it will take out of both breasts at each time . . . no other Woman's milk can be so good for her child; and dry-nursing I look upon to be the most unnatural and dangerous method of all; and according to my observation not one in three survives it." A sufficiently severe indictment of the methods of

artificial feeding in his day! At the time when Cadogan wrote one-third of the total mortality at all ages occurred under the age of two years, and a few years later (when it is possible to compare the deaths with the births), e.g. in 1762 and 1763, there were over 500 deaths under two years of age per 1,000 births, and about 70 percent, of children under five years of age.

Like Conyers he condemns in no uncertain term the practice of feeding "Pap" or giving the baby to some other woman to nurse before the breast milk is established.

However, he anticipates the twenty century book on infant feeding in United States, based book on infant feeding in United States, for he recommends that at three months of age solids should be given, and in addition to the breast feeding the infant should be fed twice a day some light food, he says "Good bread is the lightest thing I know. Cow's milk is also simple and light and very good for them but it is injudiciously prepared. It should not be boiled, for boiling alters the taste and property of it, destroys its sweetness and makes it thicker and heavier and less fit to mix with the blood. I would advise therefore that one half of infants diet be thin light broths, with a little bread or rice boiled in them which last is not so acescent as any other kind of meal or flour . . . the other part of children's diet may be a little bread and water boiled almost dry and then mixed with fresh milk not boiled. This, without sugar, spice, or any other pretended amendment whatever, will be perfectly light and wholesome . . . twice a day and not oftener a sucking child should be fed at first, once with the broth, and once with the milk thus prepared. As to the quantity at each time, its appetite must be the measure of that; its hunger should be satisfied but no more . . . When they come to be about six months old they may be fed three times a day which I think, they ought never to exceed their whole lives after. By night I would not have them fed or suckled at all . . . Let this method be observed about a twelvemonth when, and not before, they may be weaned." The child is to be "kept clean and sweet, tumbled and tossed about a good deal, and carried out every day in all weathers."

Urging mothers to suckle their children he points out how much more placid and good-tempered infants are with this feeding. "There would be no fear of offending the husband's ears with the noise of the squalling brat. The child was it nursed in this way would be always quiet, in good humour, ever playing laughing or sleeping. In my opinion a man of sense cannot have a prettier rattle (for rattles he must have of one kind or another) than such a young child."

Cadogan has this to say about the system of baby farming which was very general at this time:

"I am quite at a loss to account for the general practice of sending infants out of the home to

be suckled or dry-nursed by another woman, who has not so much understanding, nor can have so much affection for it as the parents: and how it comes to pass that people of good sense and easy circumstances will not give themselves the pains to watch over the health and welfare of their children: but are so careless as to give them up to the common methods, without considering how near it is to an equal chance that they are destroyed by them. The ancient custom of exposing them to wild beasts or drowning them would certainly be a much quicker and more humane way of despatching them."

Ruhrah makes this reference to the life of William Cadogan, "In all the wealth of propagandist literature of the numerous agencies for child welfare and the prevention of infant mortality, one has yet to see the name of Cadogan. And this, when no one else has ever put the case and its necessities more strongly. Cadogan shouts with no uncertain voice; he made himself heard and started the ball rolling. Others have pushed it along and now thousands of workers are helping; not all push in the same direction, the progress is not as rapid as it should be, but the intention is good if some of the zeal be misdirected. The proof of the work is still in the mortality bills. The rates are going down. One hopes then to see proper respect given Cadogan by the 'uplifters' as well as by pediatricists."

To those who wish to spend an extremely interesting hour, I would recommend that you read the life of William Cadogan in "Pediatrics of the Past" by John Ruhrah.

The profession in these days severely criticize the so-called counter prescribing by druggists.

In Red Lion Street, Holborn, in 1753 there lived an apothecary named James Nelson. He was married and had seven children. What a bedside clinic. Like some later writers he turned the study of his own children to good account.

He had no University training or degree and pleads for friendly forbearance and mutual co-operation between the two orders. He became widely known as the writer of a thoughtful book, "An Essay on the Government of Children under Three General Heads, viz. Health, Manners, and Education."

In his introduction he says with some truth: "Were none to engage in a state of wedlock in order to become parents till their abilities to train up their little offspring were tried and approved, I am of opinion the number of Marriage Licenses would be greatly abridged." He was an ardent reader of Cadogan but he went one better probably from experience with his seven children and advised reducing the period of nursing to nine months.

He has no objection to the giving of pap as an addition to breast-feeding, but he urges that it should be made with milk as well as water added to the bread, and says that there were

those who used water-pap only, and this even when the child was having no breast-milk. It is hardly to be wondered at that, as he mentions elsewhere, "rickets was a distemper extremely common in London."

In 1772 Dr. Hugh Smith of London published a very popular book "Letters to married women on nursing and the management of children." In the introduction he quotes figures from the bills of mortality for London and its environs. They show that about two-thirds of children born in this area died before the age of five years, and about 75% of these deaths occurred under the age of two years.

Smith says, "disease and death are the usual consequences of the present erroneous methods of bringing children up by hand."

To Smith belongs the credit of being the first writer to teach the sufficiency of breast milk alone for the feeding of infants up to six or seven months, and was much opposed to pap as a complimentary feeding as advocated by earlier writers. He is the father of what is now known as "the four hour system of breast feeding at stated hours."

At six or seven months he advised that children be fed in addition to the breast 4 ounces of broth with a little bread mixed in it, once or twice daily.

His remarks on cow's milk are interesting: "I know very well that many persons and perhaps some gentlemen in the practice of physic will differ from me in opinion when I prefer cow's milk to every other kind of nourishment in the early months where it is necessary to bring a child up by hand . . . the milk of cows appears I think to be the properest substitute we can make for that of the breast; and will answer best after the first month or two without boiling, unless it purges the child: in which case boiling it, will generally prevent the inconvenience proceeding in all likelihood from its oily particles. I have no objection to a small quantity of Lisbon sugar being mixed with it particularly if the child be costive and indeed this may very frequently be of use to prevent its too great tendency to become acid from which disorders of the bowel sometimes arise . . . In case the milk be thrown up in a curdled state a small quantity of salt will generally prevent it: a circumstance I would wish to have attended to, as many children are subject to this complaint and it is a method I have seldom known to fail unless they are greatly overfed . . ."

His contribution to the subject of infant-feeding took not only the form of advice, he was the inventor of a "bubby-pot," the object of which was to imitate nature in making the infant labour for its food. His invention was a stage in the evolution of the modern feeding-bottle.

The most advanced writer on diseases of children in the 18th century was Michael Underwood (1737-1820).

He was a member of the Corporation of Surgeons, and in 1784 became a Licentiate in Midwifery of the College of Physicians. At his death he was the last survivor of this now extinct licentiateship.

In 1783 as a surgeon he published "A Treatise upon Ulcers, Scrophulous Sores and Mammary Abscess."

In 1784 his first edition of his, "Treatise on Diseases of Children with Directions for the Management of Infants from Birth, Especially such as are brought up by Hand, appeared."

To quote Still "It is not given to many books (a volume of 288 pages) on medical subjects to pass through at least seventeen editions and to remain in favour and use for over sixty years. But Underwood's treatise was manifestly superior to anything that had been written on the subject; it gathered up all the most recent research and discovery in diseases of children. With Underwood paediatrics in England had crossed the Rubicon; the modern study of diseases in childhood had begun. There was still far to go, but Underwood had pointed the way, and with the dawn of the nineteenth century, paediatrics, thanks to him, was in a better position to go forward than it had ever been before."

Ruhrah himself in late life a victim of Poliomyelitis gives Underwood the credit of being the first to describe anterior Poliomyelitis. Still states that he was the first to include congenital heart disease in a treatise.

Underwood was greatly influenced by Harris and Cadogan, but disagrees with Cadogan, who believed that theething is scarcely to be ranked among diseases of infants. Underwood says "I have therefore no doubt but the time of dentition ought to be ranked amongst the most dangerous to infants, and the greatest attention ought to be paid to it."

My own teaching to students is that teething produces nothing but teeth.

Underwood notes the invention of the nipple shield, a new contrivance, recommended for the same purpose then as now.

The third volume of his fourth edition marks a great step forward in the matter of infant feeding. No treatise had hitherto considered the chemistry of milk.

As late as the second half of the 18th century the primitive nail test described by Soranus 1600 years before was still being taught by writers on infant feeding, so little had medicine progressed; but in 1761 an inaugural dissertation, of unusual value, had been written for the degree of M.D. in Edinburgh by a student, Thomas Young, upon milk. In this thesis he records many experiments upon milk, its behaviour with admixture of alkalies, gastric juices, etc., its composition, and the difference between fore-milk and after-milk. Thomas Young, who afterwards

became Professor in the University of Edinburgh, was a pioneer in the chemistry of milk. The following year (1762) John Ruttty published *The Analysis of Milk and the Several Species thereof*, and continental writers were also beginning to study the chemical properties of milk. Underwood quotes a table showing the analysis of human, cow's, goat's, ass's, and mare's milk by M. Boysson.

Advancing on the lines that had guided it in the last fifty years, infant feeding during the nineteenth century showed at least three notable developments. The first in importance, though not in time, was the final acceptance, after long struggles, of the principle of artificial feeding. The second was the demand for special foods suitable for infants, a need, the commercial value of which was quickly recognized and led to the growth of an enormous trade in proprietary foods. The third was the invention of a simple vessel or sucking-bottle from which a child could take its food in a natural manner. Each of these developments will be considered in turn, but we must first trace the changes in the practice of breast-feeding.

We learn that in 1802 four different methods of feeding were recognized: (1) Suckling by the mother; (2) suckling by a wet-nurse; (3) feeding with animal-milk; (4) feeding with bread and water (pap). Of these the first remained the method of choice. No one, however, appears to have made any observation on the quantity of milk secreted by women or the amount needed by infants. Consequently a silence was still preserved on all practical points dealing with breast-feeding. To make up for this, the horizon is kept filled with the question of weaning. At last, however, the belief that the matter was to be settled by counting the milk-teeth was beginning to be shaken. The object-lesson of Marcus Curious Dentatus was taken to heart and the reformers began seeking out other difficult cases. Louis XIV of France was born with a couple of teeth, so was Richard III of England.

Shakespeare had evidently heard of this curiosity, for he makes the young Duke of York say of Richard III.:

"Marry, thy say my uncle grew fast
That he could gnaw a crust at two hours old."

In the opening years of the century mixed feeding was in general use. A variety of messes was recommended for breast-fed children a few weeks old. Water-pap still figures prominently, while oatmeal, rice, or barley boiled in cow's milk is given at the end of the first month. Herbs made of cowslips or star-of-anise and milk is an excellent substitute for pap. The German custom of administering a good beer-soup as soon as the first incisors show themselves is approved of. Whether the infants of the period appreciated these dietetic experiments we cannot now tell. No surprise is felt at the contemporary mention of a "three-months belly-ache" that was pre-

valent among children of that age, or of the "weaning-sickness" that lay in wait for the breast-fed infants.

Fortunately these crude methods led before long to a reaction. By 1825 it had become recognized by many that for the first five or six months at any rate mixed feeding should be avoided, and the breast alone given. In spite of this conclusion, however, artificial feeding continued to develop, though the obstacles in its way were for a long time serious.

The greatest obstacle in the way was the high mortality among hand fed infants. In the early part of the 19th century in London, hand feeding was fatal to seven out of eight children.

The other difficulty was the lack of suitable feeding utensils. Ordinary cups and spoons were ill adapted for the purpose.

A cow-horn was the original sucking bottle first described in 1783. The horn was taken from a calf or small cow and held about a gill and a half; it was scraped and polished and its tip perforated; to a notch cut round the smaller end were tied two small pieces of parchment or leather "shaped like the tip of the finger of a glove and sewed together in such a manner as that the food passed into the horn can be sucked through between the stitches."

The impossibility of cleansing such an instrument of its accumulation of sour and decomposing milk, probably in no small way accounts for the high mortality.

The first glass feeding bottle dates from opening years of the nineteenth century. Time does not permit the various evolutions the glass feeding bottle went through, before the adoption of the feeding bottle we know.

In 1850 we find the artificially fed child provided with a fairly satisfactory feeding bottle, animal milk which was none too clean, and some choice in proprietary foods.

In 1862 artificial feeding was still in dispute because it was so unsuccessful.

In 1868 Dr. Eustache Smith's book "The Wasting Diseases of Children" appeared. Dr. Smith recommended two hourly feeds throughout with the addition of cream as well as sugar. Curiously enough he insists that the milk must not be boiled. For nearly twenty years the popular belief held that raw milk is better for children than boiled. This is still maintained even in Canada by food faddists, and not a few dairymen.

When boiling of milk became more generally adopted Dr. Smith in 1884 was able to write that the successful rearing of an infant by artificial means is not a difficult matter.

In the September 1935 number of the *Journal of Pediatrics*, Dr. John Lovett Morse under the title "Recollections and Reflections on Forty-Five Years of Artificial Infant Feeding" describes the condition in United States in the years 1889 and 1890:

"Most babies were fed on proprietary foods, a considerable proportion of which contained no milk and were mixed with water, in other words pap. Very few physicians had any idea what the mixtures contained, or would have understood, if they knew. They simply tried one after another, hit or miss. Those who used milk, with the exception of Meigs, Rotch, Holt, and a few others, had no definite plan. It was impossible to get clean milk. The importance of tuberculosis in cattle was unappreciated. The long tube nursing bottle was still in use. No one had ever heard of vitamins or calories. The few pediatricians of those days, led by Holt and Rotch, were putting up a fight in favour of milk as the food for babies instead of the proprietary foods. Rotch was sued by the Mellin's Food Company for his efforts. Much was said about milk being the natural food for the young animal. Analyses of the milks of many animals were made, and it was shown that, while the milk of the cow was not as much like human milk as that of some other animals, it should be used because it was the most abundant and most easily obtainable."

Morse critically reviews the various advances if they may so be called in the artificial feeding of infants and still maintains that the percentage method of feeding of the Boston School, cream skimmed milk, water and sugar is the most logical in that it made the food fit the particular baby rather than the present day idea of making the baby fit the food.

In the final paragraph of his paper Morse states "The most striking thing to me in reviewing these forty-five years is that, barring the discovery of the vitamins and the recognition of their importance in nutrition, in spite of all the advances in biochemistry during this time, all the innumerable investigations which have been carried out, and all the papers which have been written on the laboratory side of infant feeding, babies are now fed in almost the same way that they were at the beginning of this period. Jacobi in 1876 was feeding babies on a mixture of whole milk and barley water, boiled, to which he added cane sugar. Babies are now fed on mixtures of whole milk and water, boiled, to which Karo is added. A very large number of babies are still fed on the proprietary foods, but probably not quite as large a proportion as at the beginning of the period. It is only fair to say, however, that the proprietary foods are far better now than they were then. I am strongly tempted to remark with Puck, "Lord, what fools these mortals be."

Ruhrah devotes fifty-three pages of his book to Pediatric poems. I began my paper, quoting Soranus nail test for a perfect breast milk, and the requirements to be met by a perfect wet nurse. I shall conclude with part of a poem referring to the work of Soranus. The poem is taken from "Paedotrophia, or The Art of Nursing and Rearing Children," by Saint Marthe,

printed in Latin in 1584 and dedicated to Henry III., King of France and Poland.

If Health and Strength permit thee, don't refuse
The Child thy Nipple; nor another's use:
If to the Baby thou dost thy own deny,
Ill, will a venal Pap its Wants supply;
Ill, will the Bus'ness by that Nurse be done,
Who for another's Child neglects her own,
Yet, if thou'rt sickly, if thy Spirits fail,
If the Child's touch'd with any catching Ail,
This Duty, whether hated or desir'd,
Ceases, and 'tis no more of thee requir'd.
Then not to Suckle, is not to neglect,
But chuse a Nurse, and I'll thy choice direct.
A middle Age is best, nor Old nor Young,
Fresh be her Colour, and her Body strong;
Active and Healthy let her be, and Clean;
In Flesh, not over Fat, nor over Lean;
Long be her Neck, and broad her snowy Chest;
Her Arms of Full Extent, and Plump her Breast.
Let on each Pap a ruddy Nipple bud,
And the Twin-Hillocks strut with vary'd blood.
The Babe's delighted with a flowing Feast:
The sweetest and the whitest Milk is best.
If 'tis of an ungrateful Smell, be sure
Those Fountains to avoid, for they're impure.
Or if it sticks, when by the Finger try'd,
'Tis bad; nor shou'd it thence too swiftly glide.
She must not with a late Conception Teem,
Nor of the marriage Joy, forgotten, dream;
And as the Birth should not too long be past,
She should not lately have her Burthen cast.

POST-GRADUATE COURSE

The Post-Graduate Committee of The Faculty of Medicine announce a course of weekly lectures in Endocrinology to be held at the Medical College beginning in November. Professor A. T. Cameron will direct the course and deal with the theoretical aspects of the subject. The clinical side will be handled by various members of the faculty. This course will be open to all medical practitioners resident in Winnipeg. A full programme will be announced later.

DEPARTMENT OF NATIONAL REVENUE INCOME TAX DIVISION

—Ottawa, 9th July, 1936.

With regard to Clause 2 (i) of the Memorandum regarding Returns of Members of Medical Profession, issued under date of 28th February, 1933, wherein it is stated that as an alternative to (h) and (i) there may be allowed a charge of 10c per mile for automobiles used in the performance of professional duties, it may be said that as a result of experience since that memorandum was issued it is felt that the 10c per mile is a too liberal allowance, and while it is not proposed to reduce this allowance retroactively, yet the Department has come to the conclusion that for 1936 and subsequently this allowance shall be reduced to 8c per mile.

I shall be glad, therefore, if you will advise your members accordingly, sending me a number of copies of your circular in order that I may forward copies thereof to the Inspectors for their guidance.

C. F. ELLIOTT,
Commissioner of Income Tax.

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During the preparation of Adrenal Cortical Extract, Epinephrine is obtained as a separate product. This is the active principle of the adrenal medulla and has, of course, been used for many years to stimulate heart action; to raise the blood-pressure; to relieve attacks of bronchial asthma, etc.

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Recently considerable success has been secured in the alleviation of attacks of bronchial asthma by spraying into the mouth this more concentrated solution of epinephrine. This solution is supplied in bottles containing 1/5 fl. oz. (approx. 6 cc.), each bottle being provided with a dropper fastened into its stopper so that small amounts of the solution may be transferred for inhalation from an all-glass nebulizer.

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NEWS ITEMS

EPIDEMIC POLIOMYELITIS: There is no disease over which the public is more apprehensive and in which both the laity and the medical profession feel so helpless than Epidemic Poliomyelitis.

Acute Poliomyelitis is best described as an acute infectious fever, which may, or may not, proceed to invasion of the nervous system. Walshe submits that the practical conception of Poliomyelitis is obtained by the recognizing of the existence of three clinically and pathologically distinct stages of its evolution, but it must be emphasized that the three stages often overlap or synchronize. Sir Arthur MacNalty outlines these stages as follows:—

CLINICAL CHARACTER:

1. **"Initial Stage"**—This stage is variable in duration; it may last only a few hours and be unrecognized, or on the other hand it may extend to five or even ten days. The initial symptoms may be those commonly associated with the pre-eruptive period of the exanthemata—headache, pyrexia (102° - 103°), malaise, sore throat, tonsillitis, coryza, nasal discharge and irritability of temper. Epistaxis may occur and, in some epidemics, vomiting and diarrhoea are leading symptoms. There is no typical skin eruption; herpes and herpes zoster have been noted; erythematous or morbilliform rashes may occur, and cases have been erroneously diagnosed as scarlet fever or measles. The condition may clear up rapidly and complete recovery ensue (mild or abortive cases). On the other hand, the initial stage may merge into a second phase. Exceptionally there may be a remission period of some hours, or even days, between these phases in which the temperature falls to normal, the child appears to have recovered and perhaps is allowed to go about on the assumption that he has had a slight febrile ailment. But there comes a recrudescence of temperature and an accentuation of the disease.

2. **"The Preparalytic Stage"**—Indicates subarachnoid or meningeal invasion. It varies in intensity and duration, being at times so slight and transient as to be unnoticeable, and at others of great severity. On the whole its duration is short and it ends either in speedy recovery or passes into the paralytic stage within a few hours. The chief signs are continuation (or renewal) of the pyrexia and headache, onset of pains in the back and limbs with tenderness over the upper dorsal vertebrae, stiffness of the neck and spine with resistance to passive flexion, muscular twitchings (often indicating the site of future paralysis), hyperaesthesia, retention of urine, drowsiness and sometimes deep stupor, occasionally even opisthotonos. Diminution or disappearance of the superficial or some of the deep tendon reflexes may be the first indication of the nature of the case. Kernig's sign is frequently present.

3. **"Paralytic Stage"**—(stage of invasion of the central nervous system)—Once the virus is established in the central nervous system paralytic phenomena may appear, their character being dependent on the localization and intensity of the lesions."

Gordon states that the typical clinical case of Poliomyelitis is as follows:—

"After an incubation period of from seven to fourteen days, usually ten, the patient suffers from a relatively short febrile onset with symptoms as above described. This stage, the general systemic stage, lasts from one to two days and is usually followed by a period of remission of from two to three days.

The second stage is characterized by an exacerbation of the general symptoms and the onset of the symptoms mentioned above referable to the nervous system.

The onset of the acute paralytic stage occurs in from one to six days after the onset of the second stage."

The history of a very recent case in Manitoba exemplifies this character of the disease:—

August 4—A young female, aged 10 years, complained of slight headache, and had a temperature of 100.1 , pulse 110 for about 12 hours. There were no other signs or symptoms apparent;

August 5, 6, 7—She appeared apparently well and was running around the farm doing considerable walking in the field;

August 8—At 3 a.m. she awakened her mother complaining of pains and cramps in her legs and was visited by two physicians at 11 a.m., who found the only positive symptom to be a slight injection of the throat. Her pulse was 80 , and her temperature 98.4 . The reflexes were normal; no headache or stiffness; no abnormal symptoms. In the evening she complained of tenderness and soreness in the legs, so much so that she slept very little that night;

August 9—She was seen in the morning by two physicians and her temperature was 101.4 ; her pulse 88 . She had no headache, but her cheeks were flushed. There was slight redness in her throat and some stiffness in the back. She had vomited once during the morning and there was some generalized abdominal tenderness. The reflexes in the left leg were increased. The right leg showed complete absence of any jerk with positive Babinsky. There was no paralysis, but there was definite weakness and limp when she attempted to walk. The spinal puncture at this time showed a definite increased pressure but there is no report as to the cell count;

August 10—She showed complete paralysis of the right leg; partial paralysis of the left leg and some paralysis of the bladder.

DIAGNOSIS:

The initial symptoms of Poliomyelitis are usually indistinguishable from those of the onset of other infectious diseases, but it must be remembered that in Poliomyelitis this stage may pass very rapidly into that of involvement of the central nervous system and if there be any cause for suspicion of poliomyelitis the patient should be kept under close medical supervision so that the physician may detect the earliest sign of meningeal invasion.

Aycock and Luther describe the diagnosis of Poliomyelitis in the pre-paralytic stage as follows:—

"The child seems prostrated to a greater degree than the temperature, which is usually under 102° F., would indicate. The face is flushed, the expression is anxious, and there is frequently pallor about the nose and mouth. The throat is mildly injected, but not enough in itself to account for the child's condition. The pulse is usually rapid out of proportion to the temperature. The rest of the physical examination is negative, except for that portion which deals with the nervous system. There is frequently a rather coarse tremor when the child moves, which may be striking. There is a distinct rigidity of the neck; however, this is not as marked as that usually seen in meningitis. The patient tilts the head on the neck but does not bend the neck on the shoulders. As a result, the head can be brought about half way forward, when resistance is encountered, and the child complains of pain.

More constant and more characteristic than the stiffness of the neck is a stiffness of the spine. This is best brought out by having the patient sit up in bed and try to bend the head down on to the knees. The average child, ill with other infections, is very flexible and has no difficulty in doing this. If these patients bend forward at all it is from the hips, with the spine held rigidly. Many of them cannot assume a comfortable sitting position without propping themselves up on their arms. Anterior flexion of the spine often causes a drawing pain in the lumbar region. Kernig's sign is not usually marked at this stage, but the deep reflexes are frequently hyperactive rather than diminished, as they are later.

"A cerebral tache is almost always present, not infrequently becoming a purplish irregular blotchy line a half inch or more in width. It is the presence of these signs and symptoms which justifies a probable diagnosis of anterior poliomyelitis and calls for the final step in the diagnosis.

"This step is examination of the spinal fluid. The fluid is usually under moderately increased pressure (from 150 to 200 mm. of water). Macroscopically the fluid appears to be clear, but when viewed by transmitted light it presents a faint haziness which has been described by Zingher as a "ground glass" appearance. There is an increase in cells, usually between 50 and 250, but occasionally as high as 700 to 800, or as low as 20. These cells may be largely polymorphonuclear early, but later are lymphocytes. There is an increase in globulin."

Gordon remarks that "The diagnosis of Poliomyelitis in its early stages depends on a sound clinical suspicion and on an examination of the cerebrospinal fluid obtained by lumbar puncture. Three kinds of evidence contribute to the sound clinical suspicion, epidemiologic factors, the symptoms of the disease and the signs which may be elicited by physical examination."

During the year 1936 up until August 28th, there have been 70 cases of Poliomyelitis reported in the Province of Manitoba. 41 of these cases have occurred since the middle of June in one Municipality within a radius of ten miles. The following table shows the reported incidence of this disease in Manitoba from the year 1927 to August 17th, 1936:—

EPIDEMIC POLIOMYELITIS IN MANITOBA

1927 to August 28th, 1936.

	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
Jan.			1					1		
Feb.			2		2	2			1	
Mar.				1	1	1				
April			1	1			1			
May		1			1		1		1	
June			1					1		4
July		9	3							17
Aug. 1	99	15	5	1			2		1	48
Sept. 3	264	15	18	6	3		2	2	9	
Oct. 1	53	11	13	3			2	1	7	
Nov. 1	4	6	5		1			4		
Dec.	4		2				1			
Total	6	434	55	45	15	7	8	10	23	70

EPIDEMIOLOGY OF POLIOMYELITIS:—

Sir Arthur S. MacNalty, in review of the epidemiology of Poliomyelitis, writes as follows:—

"**Seasonal Prevalence**—Although the disease tends to occur in the temperate rather than in the torrid zone, it has a well-marked seasonal prevalence in the warm months of the year, July, August and September. August is usually the month for maximal case-incidence. Sporadic cases and small outbreaks have been recorded in other months of the year and epidemics arising in late summer and early autumn may be protracted to include later months.

"**Geographical Distribution**—The most extensive epidemics of Poliomyelitis have occurred in Scandinavia, the United States, and in Australia and New Zealand. Most of the countries in Europe have experienced the effects of this epidemic malady from time to time, and outbreaks have been studied in France by Netter, and in Germany by E. Muller, P. Krause, and others. The occurrence of the disease in South America—for example, in Ecuador—has been observed. We have little information about the occurrence of the disease in Asia and Africa. Very severe and widespread epidemics have occurred in the United States, especially in the years 1907 and in 1916. In the latter year in New York City alone 9,063 cases were reported with 2,308 deaths.

"**Mortality**—The case fatality of poliomyelitis varies in different epidemics. An average variation is from 10 to 20 per cent. It depends upon whether the mild and abortive cases of the disease are recognized or escape detection in the different epidemics.

"**Age and Sex**—The age of the patient attacked by poliomyelitis has an important influence upon the fatality rate; the younger the age the better is the chance of survival. Ruhrah and Mayer state that adults are affected generally to the extent of about 10 percent in the various epidemics, but in this there are great variations, at times the percentage being higher and sometimes much lower. If a large number of the population fall victims to an epidemic, the proportion of adult cases appears to be high; for example, Muller reported a remarkable epidemic on the island of Nauru, where in a population slightly exceeding 25,000 some 700 cases of poliomyelitis occurred within a few weeks, the majority of which were in adults. In the New York epidemic of 1916 the number of cases reported in adults was considerable. The tendency in most outbreaks of poliomyelitis for a slightly greater proportion of males than females to be attacked. The percentage of deaths in males is also slightly greater than among females.

"**First and Second Attacks**—As a rule, one attack of poliomyelitis produces permanent immunity. There are exceptional and rare cases in which a definite second attack of poliomyelitis has occurred in the same individual. Two cases of the kind were noted in the New York epidemic of 1916. Eshner has reported the case of a girl in which eleven years elapsed between the two attacks. Sanz records a similar case with fourteen years' interval.

"**Incubation Period**—In experimental observations the incubation period is stated to vary from three to forty-six days, the general period being about eleven days. Clinical observations suggest an incubation period of from two to ten days, although shorter and much longer periods have been recorded . . .

"**Transmission**—The presence of the virus has been demonstrated in the nasopharynx of patients and of persons who give no definite history of having had the disease and who may, or may not, have been in known contact with it. Presumably, infection may be spread directly not only by patients but by persons apparently healthy. There is not sufficient reason to believe that the virus of poliomyelitis is conveyed to man by foodstuffs (including milk) or insects, or that the disease is associated with insanitary conditions. In the outbreak of poliomyelitis in 1935 in New York, a recent report states that the risk of contracting the disease was found to be greater in the richer than in the poorer districts. Similar findings have been recorded from other cities."

EPIDEMIC NATURE OF THE DISEASE:

"The recognition of poliomyelitis as an epidemic disease has been extraordinarily slow and even today the epidemic characteristics are not fully appreciated by all medical practitioners.

"To the Swedish physician Medin, belongs the credit of classifying Poliomyelitis as an epidemic disease. This was in 1881. From 1883 to 1886 small outbreaks involving groups of cases were reported from Italy, France, Germany, and Norway. MacPhail and Caverly in 1894 reported the first extensive American epidemic of 132 cases in Rutland, Massachusetts.

"The first English epidemic was described by W. Pasteur in 1897; he detected Poliomyelitis in seven members of one family at Much Hadham, a small village in Hertfordshire. Subsequently, Dr. Thomas Buzzard and Dr. F. E. Batten independently described an undue prevalence of the disease in London and elsewhere.

"In 1907 the classical monograph on the subject was written by Ivor Wickman, of Stockholm, the pupil and assistant of Medin, who made a thorough study of the epidemiology and first recognized and described the so-called abortive and non-paralytic cases. These cases are of great epidemiological and public health importance and when they are not reported and isolated are mainly responsible for the spread of the disease; they appear to be as capable of diffusing the infection as the well-marked cases which develop paralysis. Though having the initial symptoms of poliomyelitis the abortive cases stop short of paralysis and seem to recover quickly.

"The study of these epidemics has confirmed and supplied additional evidence to show that human contact from one individual to another is the chief, if not the sole, means by which poliomyelitis spreads in epidemic form, as Wickman first showed.

"It is now well established that infection may be conveyed by (1) persons suffering from an acute typical attack of poliomyelitis; (2) individuals having a mild or a typical form of the malady; (3) healthy persons who have been in close contact with the sick but have not themselves developed an attack; and (4) chronic carriers who have apparently quite recovered from a previous typical attack. Infectivity in acute cases is greatest during the early stages of the disease."

It seems to be generally accepted that the route of the virus from the nose is through the olfactory nerves, bulb and tract and thence through connecting tracts to the medulla and cord, avoiding the cerebral cortex and cerebellum.

PREVENTION:

The following are the remarks of Sir Arthur MacNalty, Chief Medical Officer of the British Ministry of Health, on this subject:—

"In epidemics of Poliomyelitis infection is probably wide-spread in a community, but only a certain proportion of susceptibles are attacked.

"Until medical research has provided us with new weapons to combat Poliomyelitis, it behoves us to study the disease attentively and to learn from the established facts of its epidemiological behaviour and pathology what measures of prevention, administrative and otherwise, are practicable and desirable.

"... personal experience has convinced me that much can be done with the whole-hearted co-operation of medical officers of health and general practitioners to check the spread and severity of an epidemic. If the infectivity of

the disease is fully appreciated, if the existence of abortive and mild cases is realized, and if these as well as the more easily recognizable cases are notified and isolated in hospital or otherwise, potential sources of infection are shut off from susceptible individuals; thereby the exaltation of virulence by passage from individual to individual is prevented and the epidemic spreads to a much lesser extent than if uncontrolled. These are reasonable assumptions.

"As regards the measures that can be taken, first of all it is incumbent upon both medical officers of health and practitioners to improve the standard of notification of poliomyelitis. As judged from the patients who are seen at orthopaedic clinics suffering from the paralytic effects of the disease, many cases still fail to be notified in the early and acute stages. Particularly in epidemic periods an alert watch should be maintained for the abortive and mild types."

PRECAUTIONS AGAINST INFECTION:

It is difficult to say how long a patient remains infectious, but he should be isolated until three weeks after the onset of the disease providing all temperature has disappeared. Those in attendance should bear in mind that infection may be conveyed from discharges, particularly from the nasopharyngeal secretions and a surgical standard of nursing is indicated.

Contacts of the patient are to be quarantined for fourteen days from the date of the last exposure to a recognized case and food handlers are not to engage in their occupation for fourteen days after the last exposure to infection.

The house in which a case exists is to be placarded.

Recent experimental work undertaken by Armstrong and Harrison on the value of the application of chemicals to the nasal mucus membrane as a possible protective measure is summed up by these authors as follows:—

- "1. The instillation of various chemicals into the nostrils tends to prevent internal infection of mice with encephalitis virus (St. Louis type) and of monkeys with poliomyelitis virus.
- "2. Picric acid, 0.32 to 0.64 percent either alone or combined with alum, was found to be superior to 4 percent alum and to be the most satisfactory and efficient experimental agent so far tried by the writers.
- "3. Picric acid in the concentration and amounts employed was devoid of detectable general or local injurious effects on animals. Sixteen applications sprayed by means of an atomizer into the nostrils of the authors produced no detectable injurious effects.
- "4. It is believed that picric acid exerts its protective effects locally, either by rendering the mucous membranes less permeable to infection or possibly by a direct action on the virus itself, or both.
- "5. The use of picric acid does not prevent the development of specific immunity in mice following a subsequent intranasal instillation of encephalitis virus.
- "6. Picric acid given to mice 1 and 2 days before, 1 and 2 days after, or on the same day as the virus instillation, led to a decreased susceptibility to the virus in all instances, as compared with nonprepared controls.
- "7. The protective effect of 0.32 percent picric acid is apparent against intranasally inoculated poliomyelitis for at least 4 to 7 days following its last administration.
- "8. Intranasally instilled chemicals effective in preventing encephalitis in mice have been found

effective against poliomyelitis in monkeys, suggesting that the former may be utilized as an indicator in a further search for more effective prophylactic agents in the latter ailment."

Further in this connection the Public Health Reports by the United States Public Health Service of July 17th, 1936 contains the following statement:—

"Statement regarding Nasal Spray as Preventive of Poliomyelitis: The recent experimental work by Doctors Armstrong and Harrison in preventing poliomyelitis in monkeys by the use of a nasal spray has excited so much interest and speculation that the Public Health Service deems it desirable to issue the following statement:

"The evidence regarding this method is as yet based entirely upon animal experimentation and the proposed spray is not at present to be regarded as of proved value in the prevention of Poliomyelitis in man. It may be advisable to await the results of further trials before giving the method general application. If, however, it is desired to use the solution, it should be sprayed into the nostrils three or four times on alternate days, and thereafter weekly during the presence of poliomyelitis. The spray tip should be pointed upward and backward at an angle of about 45°, and the spraying should be thorough enough to reach the pharynx as well, when a bitter taste will be noted. The early applications at least should be administered by a physician. The experimental work on animals is still being pursued. The tentative procedure is, therefore, subject to such changes as may be dictated by future findings.

"The most effective solution so far developed during experimentation on monkeys is prepared as follows:

Solution A: Dissolve 1 gram of picric acid in 100 cc of physiological salt solution (0.85 percent). (Warming facilitates solution of the picric acid).

Solution B: Dissolve 1 gram of sodium aluminum sulphate (sodium alum) in 100 cc of physiological salt solution (0.85 percent). Any turbidity in this solution should be removed by filtering one or more times through the same filter paper.

Mix Solutions A and B in equal amounts. The resulting mixture, which contains 0.5 percent picric acid and 0.5 percent alum is sufficiently antiseptic to prevent the growth of organisms and is ready for use as a spray. Homemade concoctions are not favored."

HUMAN CONVALESCENT SERUM:

Different reviews of the question as to the efficacy of human convalescent serum in the early stages of the disease appeared to yield rather inconclusive results. In Manitoba, serum is provided by the Provincial Laboratory at Winnipeg, and there appears to be some evidence to the effect that if used early, particularly within twelve hours of the onset, beneficial results are obtained.

ACTIVE IMMUNIZATION AGAINST POLIOMYELITIS:

Considerable work has been done by Kolmer and Brodie in this field. Kolmer's vaccine is supposed to be attenuated virus by treatment with sodium ricinoleate; while Brodie's vaccine is virus killed with formalin. These authors presented their material at the 1935 Annual Meeting of the American Public Health Association, but it was felt although Brodie's vaccine was safe it was not necessarily efficacious. On the other hand the opinion was expressed that Kolmer's vaccine was probably undesirable for use in its present state as there appeared to have been cases of paralytic Poliomyelitis following its use, and

Leake of the United States Public Health Service strongly recommended that the use of this vaccine in its present state be discontinued.

In the discussion which followed Rivers stated:

"Experience showed that recovery from most virus diseases results in an enduring immunity. Later it was found that the sera of individuals recovered from certain of these maladies possess neutralizing or protective antibodies. Consequently, a number of workers think that the presence of neutralizing antibodies in the serum of a person always indicates that the individual is immune. This is probably true when the antibodies are the result of a natural infection. In other words, the individual is known to be immune not because of the antibodies, but because of recovery from a natural infection as indicated by the persistence of antibodies.

"The state of affairs may be different when a host is artificially immunized against certain virus maladies. Why?—I do not know. In any event, in vaccinated individuals resistance to infection does not necessarily parallel the presence of neutralizing antibodies, as has been demonstrated in dogs vaccinated against rabies. Furthermore, Hudson, Schultz, and Olitsky have shown that monkeys vaccinated against poliomyelitis may be susceptible to infection in spite of the presence of neutralizing antibodies in their sera. It is evident that the above observations are of significance when one attempts to evaluate the work of Brodie and Kolmer who lay a great deal of stress upon the fact that monkeys and human beings vaccinated according to their methods against poliomyelitis develop or increase the amount of antibodies in their sera.

"There is one fact that must be held in mind. It is that the virus of Poliomyelitis, either active or inactive, acts as though it was a poor antigen. Even large amounts of it in the active state administered intracutaneously or subcutaneously do not regularly produce resistance to infection in monkeys. Furthermore, intracerebral doses of active Poliomyelitis virus, too small to induce an obvious infection in monkeys, will not immunize the animals. Thus it does not follow that the introduction of active virus into monkeys and human beings will result in their effective immunization against infection. This fact is well illustrated by the findings of Schultz and Olitsky who repeated Kolmer's work on monkeys and were unable to demonstrate as much protection as that reported by Kolmer for his animals.

"The amount of antigen in the form of active poliomyelitis virus is a very important item in attempts to immunize monkeys by way of the intracutaneous or subcutaneous route. Even large amounts are not always effective, and investigators working in the effective range have invariably found that an occasional monkey becomes paralyzed as a result of the immunizing doses, and, for this reason, have considered it inadvisable to use active virus for the vaccination of human beings." —C.R.D.

COMMUNICABLE DISEASES REPORTED

Urban and Rural - July, 1936.

Occurring in the Municipalities of:

Measles: Total 250—Winnipeg 54, Unorganized 42, Portage Rural 11, Woodlands 8, Dufferin 3, Minto 3, Portage City 3, Brooklands 2, Lakeview 2, Macdonald 2, Norfolk North 2, Rockwood 2, Thompson 2, Virden 2, Brandon 1, Brokenhead 1, Dauphin Town 1, Gimli Rural 1, Russel Town 1, Siglunes 1, St. Vital 1, The Pas 1, Victoria Beach 1, Whitemouth 1, Late Reported: May, Cartier 2, Harrison 1, June, Lac du Bonnet 85, Thompson 11, Unorganized 3.

Scarlet Fever: Total 90—Winnipeg 59, St. Vital 5, St. James 4, Kildonan East 3, Mossey River 3, Ste. Anne 2, Archie 1, Assiniboia 1, Cameron 1, Charleswood 1, Gilbert Plains Rural 1, Minto 1, Selkirk 1, Springfield 1, St. Laurent 1, Unorganized 1, Winnipeg Beach 1, Woodlands 1, Late Reported: June, St. Vital 2.

Chickenpox: Total 84—Winnipeg 22, St. Vital 20, St. James 17, Whitewater 9, Minto 5, St. Boniface 3, Brandon 2, Unorganized 2, Cameron 1, Flin Flon 1, Portage Rural 1, Victoria Beach 1.

Tuberculosis: Total 79—Winnipeg 12, Unorganized 10, St. Vital 6, Brandon 3, Ethelbert 3, Bifrost 2, Dauphin Rural 2, Lorne 2, Louise 2, Pipestone 2, St. Boniface 2, St. Laurent 2, Brokenhead 1, Carberry 1, Charleswood 1, Cornwallis 1, Fort Garry 1, Gilbert Plains Rural 1, Gilbert Plains Town 1, Gimli Town 1, Glenwood 1, Hartney 1, Lansdowne 1, Minnedosa 1, Morton 1, Norfolk North 1, Portage Rural 1, Portage City 1, Rapid City 1, Riverside 1, Roblin Town 1, Selkirk 1, Shell River 1, Springfield 1, Stanley 1, Swan River Town 1, St. Andrews 1, St. Clements 1, St. James 1, Ste. Rose 1, Tache 1, Virden 1, Westbourne 1.

Whooping Cough: Total 25—Winnipeg 21, Rosser 1, Selkirk 1, St. Andrews 1, Victoria Beach 1.

Diphtheria: Total 24—Winnipeg 7, Whitemouth 6, Whitewater 4, Minitonas 3, La Broquerie 1, Macdonald 1, Late Reported: April, Tache 1, June, Whitewater 1.

Mumps: Total 23—Unorganized 8, Winnipeg 5, Minto 2, Norfolk North 2, St. Paul East 2, Ethelbert 1, Roland 1, St. James 1, Victoria Beach 1.

Anterior Poliomyelitis: Total 12—Morton 6, Boissevain 2, Brandon 1, Dufferin 1, Rockwood 1, Late Reported, June, Morton 1.

German Measles: Total 12—Unorganized 3, Brooklands 2, Gimli Rural 2, Brandon 1, Roland 1, St. Boniface 1, Late Reported: June, Brandon 2.

Erysipelas: Total 8—Winnipeg 6, Siglunes 1, Ste. Anne 1.

Influenza: Total 7—Winnipeg 1, Late Reported: April, Strathcona 1, May, Brandon 1, Cypress North 1, Hamiota Town 1, Hanover 1, Saskatchewan 1.

Typhoid Fever: Total 6—Birtle 2, Brandon 1, Elton 1, St. Clements 1, Tache 1.

Septic Sore Throat: Total 2—Cameron 2.

Diphtheria Carriers: Total 2—Winnipeg 2.

Puerperal Fever: Total 1—Winnipeg 1.

Cerebrospinal Meningitis: Total 1—Brandon 1.

Venereal Disease: Total 129—Gonorrhoea 96, Syphilis 33.

DEATHS FROM ALL CAUSES IN MANITOBA

For the Month of June, 1936.

URBAN—Cancer 40, Tuberculosis 10, Pneumonia 7, Scarlet Fever 2, Syphilis 2, Influenza 1, Lethargic Encephalitis 1, German Measles 1, Measles 1, Puerperal Septicaemia 1, Typhoid Fever 1, Erysipelas 1, all others under one year 4, all others 135, Stillbirths 8. Total 215.

RURAL—Cancer 23, Tuberculosis 17, Pneumonia 16, Influenza 5, Measles 4, Diphtheria 1, Infantile Paralysis 1, Lethargic Encephalitis 1, Mumps 1, Puerperal Septicaemia 1, Typhoid Fever 1, Whooping Cough 1, Erysipelas 1, all others under 1 year 5, all others 165, Stillbirths 19. Total 262.

INDIAN—Tuberculosis 8, Pneumonia 2, Influenza 1, Cancer 1, all others under 1 year 1, all others 9, Stillbirths 1. Total 23.

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Medical Library University of Manitoba

"The American Journal of the Medical Sciences"—
August, 1936.

"Acute Post-operative Necrosis of the Liver"
(so-called High-temperature liver death
Syndrome)—by John E. Sutton, Jr., M.D.,
F.A.C.S., Bellevue Hospital, New York.

The similarity of this condition in man and that
in dogs following ligation of the hepatic arteries is
noted. Thirty diagrams indicate as many variations
in the anatomy of the Hepatic Vessels in man.

"Acute Epidemic Encephalitis"—A Clinical
Study of 160 Cases—by H. A. Slesinger, M.D.,
Windber, Pa.

Reports of 160 cases seen over a period of two
months are given. The disease was highly contagious,
ran a benign course and carried very few residual
symptoms. Convalescent serum was of definite value
both as a prophylactic measure and in the active treat-
ment of the disease.

"Treatment of Peptic Ulcer by means of Injec-
tions"—by C. A. Flood, M.D., and C. R.
Mullins, M.D., New York.

A series of cases treated with Histidine was com-
pared to a control group treated by injection of
normal saline. Eight of twelve patients treated by
daily injections of saline experienced relief of pain.
Four of six patients treated with histidine showed
relief of pain. It is suggested successful results in
this form of therapy are due to the psycho-therapeutic
value of the injections rather than the nature of the
solution used.

"The Lancet"—August 8th, 1936.

"Operative Treatment of Severe Gastric
Haemorrhage of Ulcer Origin"—by Hans
Finsterer, M.D., Professor of Surgery,
University of Vienna.

"Annals of Surgery"—August, 1936.

"The Surgical Treatment of Irremovable Cancer
of the Pyloric Segment of the Stomach"—
by Rodney Maingot, F.R.C.S. (Eng.),
London.

"The Journal of the American Medical Association"—
August 15th, 1936.

"Resistance in Tuberculosis"—by James A. Mil-
ler, M.D., and Israel Rappaport, M.D., New
York.

"Pathogenesis of Tuberculosis"—by Max Pinner,
M.D., Oneonta Tuberculosis Hospital,
Oneonta, New York.

"Intravenous Treatment of Meningococcic Men-
ingitis with Meningococcus Antitoxin"—by
Archibald L. Hoyne, M.D., Chicago.

"Athletic Injuries"—by Marcus H. Hobart, M.D.,
Evanston, Ill.

"The New England Journal of Medicine"—
August 13th, 1936.

"Convalescent Care in Chronic Arthritis"—by
John G. Kuhns, M.D., and Robert J. Joplin,
M.D.

**"The Canadian Medical Association Journal"—
August, 1936.**

- "Internal Secretion as a Factor in the Origin of Cancer"—Leo Loeb, E. L. Burns, V. Suntzoff and Marian Moskop, St. Louis, Mo.
- "Observations in the Action of Protamine and Insulin in the Treatment of Diabetes Mellitus"—by I. M. Rabinowitch, A. F. Fowler and A. C. Coreoran, Montreal.
- "Studies in Mineral Metabolism."
- "Calcium and the Kidneys: Clinical"—by Bruce Chown, M.D., Winnipeg.
- "Experiences in Leg Lengthening"—by E. C. Janes, M.D., (Tor.), Hamilton.
- "The Moose River Mine Accident"—by H. K. MacDonald, M.D., C.M., Professor of Surgery, Dalhousie University, and W. Donald Rankin, M.D., Halifax.

- "The Effects of Privation in the Moose River Mine Disaster"—by Ian MacDonald, B.A., M.D., C.M., M.R.C.P. (Lond.), Halifax.
- "Recent Progress in Severe Diabetes"—by Priscilla White, M.D., George F. Baker Clinic, E. P. Joslin, Medical Director, Boston.
- "An Unusual Case of Meningococcus Meningitis"—by John V. V. Nicholls, B.A., M.Sc., M.D., Montreal.
- "The Treatment of Empyema Thoracis"—by O. W. Niemeier, M.B., M.D., F.R.C.S., (Edin.), F.R.C.S. (C.), Hamilton.
- "Autogenous Serum Treatment of Narcotic Addiction"—by Donald M. Black, M.D., St. Andrews Hospital, Lunenburg, Nova Scotia.
- "Chronic Sinusitis"—by G. Edward Tremble, M.D., Montreal.

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Clinical Section

Anterior Poliomyelitis

The first meeting of the Winnipeg Medical Society for the season, held on September 18th, was given over to a symposium on Anterior Poliomyelitis. Following the various papers, the meeting was opened for general discussion. The President, W. E. Campbell, B.A., M.D. (Man.), was in the chair.

Clinical Features

By

LENNOX BELL, M.D. (Man.), M.R.C.P. (Lond.),
*Lecturer in Medicine, University of Manitoba,
Assistant Physician to the Winnipeg
General Hospital*

The purpose of this meeting tonight is to review the facts concerning the present outbreak of poliomyelitis, to re-emphasize the value of convalescent serum in the preparalytic stage, and to discuss the prevention, control, and the early recognition of the disease. Whatever I may have to say will be of a very general nature and refers merely to my experience during the epidemic of 1928, when I was privileged to assist the staff of King George Hospital in recording the case histories of patients admitted to that institution.

J. E. Gordon has stated that the diagnosis of preparalytic poliomyelitis consists of "**a healthy clinical suspicion and a lumbar puncture.**" The prompt suspicion of the disease from clinical evidence is the task that confronts every practitioner during an epidemic.

Experimental evidence strongly suggests that poliomyelitis is entirely neurotropic—that the virus travels from the nasopharynx through the cribriform plates, along the olfactory nerves to the central nervous system where it is propagated along nerve tracts. However, the early clinical history of the disease suggests an *initial systemic reaction* marked by constitutional symptoms such as fever, malaise, gastro-intestinal upsets with vomiting, diarrhoea or constipation. This is quickly followed by the *preparalytic stage proper* with symptoms due to invasion of the central nervous system—headache, irritability or drowsiness, hyperaesthesia, pain on spinal flexion, changes in reflexes, etc. The *final state of paralysis* usually occurs on the second or third day after the onset—except in the so-called "*dromedary*" type where the initial symptoms clear up entirely and then several days later re-appear with onset of paralysis. Undoubtedly many *abortive cases* also occur during an epidemic which frequently pass unnoticed. One must also mention the *fulminant type* with rapid bulbar involvement and death which seem prone to occur during the earlier stages of epidemics.

In the common spinal form the earliest symptoms are not characteristic. The child feels out of sorts and often peevish and disinclined to play, fever is the rule—generally moderate 100°-102°, appetite is lost and vomiting may occur with some looseness of the bowels. Frontal headache occurs early in most cases, and is followed by *painful stiffness of the neck* and spine so that the child resents any movement. This gives rise to the very valuable "*spine sign.*" The child is often unable to sit upright without supporting himself on his arms and assumes a rather erect, proud position. Attempting to flex the knees and neck to bring the head between the knees demonstrates rigidity of the spine and elicits pain in the neck and in lumbar region. A weakly positive Kernig's sign may sometimes be found. Early in the course of the disease the *reflexes* may be hyperactive but later are generally diminished, especially the superficial reflexes; the tendon reflexes are generally asymmetrically involved. A rather coarse ataxic *tremor* may be evident whenever the child moves. Twitching of various muscle groups may be observed, especially during sleep. Many observers report a characteristic expression during the early stages, described as a "*dazed look*"—"a vague apprehension," etc.

The onset of fever and constitutional symptoms associated with headache, rigid spine and neck calls for the performance of *lumbar puncture*. There may possibly be some slight danger of initiating involvement of the central nervous system if lumbar puncture is performed too early, but such danger seems rather remote in contrast to the value of C.S.F. examination for establishing a definite diagnosis. The fluid is usually clear or faintly opalescent, under moderately increased pressure (150-200 mm. water). The cell count is increased usually from 15-500, with an average of about 25-40 predominantly lymphocytes, except in the very early stages when polymorphs may occur. A slight excess of globulin appears usually on the second or third day. Sugar and chlorides are usually normal in poliomyelitis in contrast with the usual increased sugar of epidemic encephalitis and the decrease chloride content of tuberculous meningitis. A weak mid-zone reaction is usually evident in the colloidal gold curve. Lumbar puncture is of great value not only in establishing a definite diagnosis of poliomyelitis but also in differentiating the condition from meningococcal meningitis, encephalitis lethargica, and tuberculous meningitis. It also serves to differentiate poliomyelitis from diseases with an intact nervous system and thus save a waste of convalescent serum. There is a tendency during an epidemic to inject serum into every child exhibiting constitutional symptoms, or pain in the extremities; thus, cases of osteomyelitis, acute rheumatic fever, etc., may be wrongly diagnosed. A careful consideration

of the history, physical signs, and, if necessary, examination of spinal fluid, will usually prevent mistaken diagnosis.

The question of administering convalescent serum to cases in whom paralysis has already set in is a point for discussion. It is doubtful whether the late administration has much effect on the degree of paralysis, but a distinct amelioration of general symptoms is usually seen. Some patients during the preparalytic stage complain of a generalized paresis which does not necessarily mean irreparable involvement of anterior horn cells, and such patient should not have the benefit of serum withheld.

A Brief Review of the 1928 Epidemic

By

JOHN M. McEACHERN, M.B. (Tor.), F.R.C.P. (C.)

Lecturer in Medicine, University of Manitoba,

Assistant Physician to the Winnipeg

General Hospital

My first experience with epidemic poliomyelitis was in 1926 when as resident pathologist under Professor Wm. Boyd I had the opportunity of studying 6 cases of a very peculiar type. The striking feature of these cases was the common occurrence of bulbar paralysis with no sign of involvement of the limbs. A number of these children died of acute oedema of the lungs.

In 1928 the Medical Research Committee under the chairmanship of Professor C. R. Gilmour appointed a number of us to act as Honorary Consultants to aid in the diagnosis and treatment of the disease. A brief review of this epidemic should be of interest at the present time. Four hundred and thirty five cases were reported throughout the province between July 1st and November 15th during that year.

The following table compiled by Professor A. T. Cameron shows the incidence of the disease by months. It will be seen that the peak of the epidemic occurred in September. In fact in the city the peak load of cases occurred on September 4th.

TABLE I

Month	Winnipeg	Suburbs	Rest of Province	Total
July	14	4	3	21
August	87	24	32	143
September	112	34	85	231
October	22	4	9	35
November (to 15th)	0	1	4	5
Totals	235	67	133	435

The daily records suggested an increased incidence every 5 to 7 days. The incidence of age and sex is shown in Tables II and III.

TABLE II
INCIDENCE OF AGE

	Winnipeg		Suburbs		Rest of Province		Total	
	No.	%	No.	%	No.	%	No.	%
Less than 5	76	32.6	22	34	32	24.8	130	30.5
5 to less than 10	82	35.2	31	48	38	29.5	151	35.4
10 to less than 15	40	17.2	8	13	29	22.5	77	18.1
15 to less than 20	22	9.5	3	5	18	14.0	43	10.1
20 to less than 25	8	3.4	0	0	4	3.1	12	2.8
25 and over	5	2.1	0	0	8	6.1	13	3.1
Totals	233	100.0	64	100	129	100.0	426	100.0

TABLE III

Incidence of Sex

No. of males 233 55.7%
No. of females 185 44.3%

It is interesting to note here that the disease is affecting children of lower age during the present epidemic suggesting that the older children acquired immunity during the 1928 epidemic. It is also interesting to note that there were no cases from Boissevain where very heavy infection has occurred this year.

Of the 37 deaths which occurred in this epidemic 17 occurred outside the city.

Convalescent serum was used extensively during the epidemic under the direction of Professor F. T. Cadham. Over 8,000 c.c. was issued during the epidemic. The ratio of serum treated to reported cases was very high during September.

One hundred and sixty one cases were specially studied during the epidemic and careful records kept. Of these 161 cases 74 received serum in the preparalytic stage of the disease, 54 received no serum and 33 received serum after paralysis had occurred.

The results of serum therapy are summarized in Table IV.

TABLE IV

Group	No. of Cases	No. Completely Recov-ered	Percent Completely Recov-ered	Number Showing Residual Paralysis	Percent Residual Paralysis	No. Deaths	%
I	57	53	93	4	7	0	0
II	17	16	94	1	6	0	0
III	33	7	22	15	45	11	33
IV	54	14	26	34	63	6	11

Group I—1 dose intramuscular serum in pre-paralytic stage.

Group II—2 or more doses of serum by various routes (pre-paralytic stage).

Group III—Serum given after onset of paralysis.

Group IV—No serum given.

Granted that the virus becomes attenuated in the later stages of an epidemic, in order to prove conclusively that serum is effective it becomes necessary to compare the figures during one given month of the epidemic. That there is such a decrease in severity is shown in Table V.

TABLE V

	Number of Cases	Early Paralysis %	Residual Paralysis %	Deaths %	Complete Recovery %
August— Cases without serum treatment	28	96	68	18	14
September— Cases without serum treatment	22	82	59	5	36

If, however, we compare the results of serum treatment with those of the controls, for the month of September, we find that the decrease in virulence indicated in Table V is much less evident than the improvement indicated by the figures for treated cases shown in Table VI. For example, of the 22 cases in September who received no treatment 36 per cent made a complete recovery, while of 50 cases in the same month who received serum in the pre-paralytic stage 94 per cent made a complete recovery.

TABLE VI

	Number of Cases	Early Paralysis %	Residual Paralysis %	Deaths %	Complete Recovery %
September— No serum	22	82	59	5	36
September— Serum in pre-paralytic stage	50	10	6	0	94

It is generally recognised that the effect of the virus is greater in the country than in the city—that cases are more severe in the rural districts. If our control cases were entirely from the country and the treated cases from the city our results would be open to criticism. In Table VII the September cases are further divided into those from the city, and those from the country.

TABLE VII

CITY CASES IN SEPTEMBER

	Number of Cases	Early Paralysis %	Residual Paralysis %	Deaths %	Complete Recovery %
No serum	14	86	50	7	43
Serum in pre-paralytic stage	43	7	5	0	95

COUNTRY CASES IN SEPTEMBER

	Number of Cases	Early Paralysis %	Residual Paralysis %	Deaths %	Complete Recovery %
No. serum	8	75	75	0	25
Serum in pre-paralytic stage	7	29	14	0	86

A final criticism may be raised: Are not the beneficial results observed in the serum-treated cases due to the fact that they are milder cases, that the controls for the most part are those seen after paralysis had occurred? This objection is not so easily disposed of, but we may answer it from several different angles.

First, the marked actual differences in percentages of complete recovery between the treated cases and the controls in September should in themselves be sufficient to override this objection.

Secondly, during that month nearly every case occurring in the city was seen by the Committee, and there is no reason to suppose that the severe cases were almost entirely absent from the treated group of nearly 60 cases.

Thirdly, if we assume that serum has no therapeutic value whatever, an accurate analysis according to the statistical method by a qualified statistician has shown that the results shown in Table V. could only occur once in five hundred times. The arbitrary level of significance is taken to be one in thirty.

Fourthly, following Draper's view that a cell count of over 100 indicates a serious type of disease (8), a comparison of the cell counts in treated cases and controls in Table VI. shows no appreciable difference in numerical incidence of the counts from which it would follow that there is no significant difference in the average severity of the two groups of cases. 92% of these counts in the treated cases were made by the fifth day of the disease. 82% were made by the fifth day in the controls. The difference of 10% is not felt to be significant as there is no marked change in the cell counts during the first week of the disease. (Peabody 5).

TABLE VIII

INCIDENCE OF CELL COUNTS IN TREATED AND CONTROL CASES

Cell Counts	Treated Cases	Control Cases
10- 99	36	23
100- 199	12	10
200- 299	6	4
300- 399	0	0
400- 499	2	1
500-1000	2	2
1000-2000	2	0
Total	60	40

Finally, it is felt that a comparison of the results in cases which had early paresis or paralysis with the end results will give us the true index of recovery, in treated and untreated cases. It is well known that the initial lesion is the ultimate reaction to the virus. For example, no case which initially developed paresis without paralysis, subsequently—that is after a lapse of three or four weeks—developed paralysis. The results of the comparison are seen in Tables VII and VIII.

TABLE IX

END RESULTS IN CASES WHICH HAD EARLY PARESIS OR PARALYSIS

	Number of Cases	Percent Recovered	Percent Residual Paralysis or Death
Treated Groups I and II	13	62	38
Control Groups III and IV	82	20	80

TABLE X
RESULTS IN CASES WHICH HAD EARLY
PARESIS ALONE

	Number Cases	Percent Recovered	Percent Residual Paralysis
Treated Groups I and II	12	67	33
Control Groups III and IV	30	40	60

These results seem to justify the use of serum in the pre-paralytic stage.

IMMEDIATE RESULTS FOLLOWING
THE USE OF THE SERUM

Within a few hours following the use of the serum the usual result was a drop in temperature and complete recovery from most of the symptoms complained of. It should be noted, however, that a drop in temperature and apparent beneficial results following the use of the serum occurred in cases afterwards proved to be ordinarily febrile disturbances and not poliomyelitis. This, of course, does not detract from the therapeutic value of convalescent serum in poliomyelitis, but indicates that some part of the beneficial effect may be due to other than specific factors in the serum.

CONCLUSIONS

1. Convalescent serum is of value when administered in the pre-paralytic stage of the disease.

2. The intramuscular route of administration is simple, safe, and sufficiently efficacious to justify its use during an epidemic.

(Associated in this work were Drs. Gilmour, Cadham, A. T. Cameron, B. Chown, L. G. Bell and Mary MacKenzie).

**Report of Poliomyelitis Outbreak
in Morton Municipality, 1936**

By

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Eight deaths and eight cases of residual paralysis in Morton Municipality since June 18th have tragically exemplified the description by Simon Flexner that poliomyelitis is "one of the saddest of diseases." The picture, however, has its brighter side also, as there have been over 30 cases in which complete recovery has occurred. My remarks, as far as statistics are concerned, will be based entirely on the cases occurring in Morton Municipality, although opinions expressed have been formed from studying over 75 cases throughout the province during the summer.

INCIDENCE

General Incidence. An approximate estimate of the incidence among a general population is impossible because a considerable number of mild cases are either never recognized or never notified. The rural Municipality of Morton, including the town of Boissevain, has a population of 2,666, and since June 18th there have occurred 47 cases, giving a

case incidence of 17.3 per 1,000. This is not taking into account several additional cases where serum was administered, but on which diagnosis was unconfirmed. This extremely high rate may be accounted for by three factors: (1) a highly susceptible population, no cases having occurred here for over 20 years; (2) the particularly high virulence of the virus in this epidemic. This is borne out by many instances, and particularly should it be noted that of the first six cases, three died and three have residual paralysis. The first eight cases all occurred within an area of 6 miles diameter, showing it to be an outbreak of great intensity. (3) Possibility for wide dissemination of the virus by contact existed for the first few weeks after the initial outbreak. Altogether, 31 cases occurred in the country and 16 in the town, giving a case incidence in the rural sections of 16.2 per 1,000 as against 19.3 in the town.

It may be of interest to observe the incidence of cases by weeks during the epidemic. It lasted altogether 12 weeks. During the first week there were two cases with a five day interval between. Then there was an interval of 16 days until the third case occurred, and following this, a further interval of 10 days until the fourth case. This brings us to the fifth week. Now there was a sudden outbreak of 8 cases occurring in four days. This was followed by a five day interval of no cases, and in the next week there were 4 cases. For the next three weeks the period of greatest intensity occurred, 11 cases in the seventh week, 11 in the eighth week, and 7 in the ninth week. Then there was, as is usual, the almost abrupt fall of incidence, only one case occurring in each of the three succeeding weeks, and these all of a very mild nature.

Sex played no appreciable factor in the outbreak, cases being equally divided amongst the male and female. **Age**, however, was of greater significance, and was felt to have an important influence on the fatality rate. It has been proven that the younger the age of the patient attacked with poliomyelitis, the better the chance for survival. (1) In this series of cases the ages varied between 3 years and 47 years. The average of males was 16.1 and of females, 15.9, a much higher average than is usual. An analysis of age groups shows the following:—

		Morton 1936	Manitoba 1928
Less than 5 years	3 cases	6.4%	30.5%
5 to 10 years	9 cases	19.5%	35.4%
10 to 15 years	9 cases	19.5%	18.1%
15 to 20 years	13 cases	28.2%	10.1%
20 to 25 years	4 cases	8.9%	2.8%
Over 25 years	8 cases	17.4%	3.1%

It will be seen that the greatest age incidence occurred in the 15-20 group, and that nearly 50% of cases occurred between the ages of 10 and 20. The comparison with the age groups affected in the province during the epidemic of 1928 shows a striking comparison, 66% of these cases occurring under the age of ten years. This high age incidence in the present outbreak, would also account for the high mortality rate.

MORTALITY

There have been eight deaths, giving a case fatality rate of 17.3%, this also proving the virulence of the infecting organism. Eight cases had a residual paralysis, leaving a complete recovery of 65.4%.

INCUBATION PERIOD

Contact was traceable in 29 of these cases. In the remaining 18 cases, no such history could be elicited. The interval between known contact and onset of symptoms varied between four days and nineteen days, with an average for the total of 10.6 days. However, in some instances, we were able to get very definite information. For instance, 7 cases occurred where two in the one family contracted the infection. In two of these instances the illness occurred on the same day within a few hours of each other, obviously having contracted infection from a common source. Of the other five, one occurred seven days following the first case, three occurred eight days later, and one on the ninth day. The families were, of course, in quarantine and therefore no outside source of contact was possible. Altogether we have eight proven cases where onset of symptoms occurred on the seventh or eighth day following contact or exposure, and this we take to be the nearest approach to accuracy in the matter of incubation period.

TRANSMISSION

It is probable that an epidemic of Poliomyelitis is preceded by a carrier epidemic, in which the virulence becomes raised. The carrier, usually an adult, carries the virus for two to three weeks in his naso-pharynx, then it dies out. (2) The incidence of infection during an epidemic, is much greater than the incidence of disease. The presence of the virus has been demonstrated in the naso-pharynx of patients and also of those who give no definite history of having had the disease, and who may or may not have been in known contact with it. It is probable that this latter group harbour the virus in a more or less stable equilibrium with the host, and that traumatic conditions or lowered resistance allow it to ascend the central nervous system. (3) A factor bearing this out, and which has been a common finding with medical men throughout the province where Poliomyelitis has been prevalent this summer, is the abnormally high number of patients complaining of indefinite symptoms such as malais, headache, slight stiffness of neck or back, perhaps an irritated throat, with very little if any disturbance of pulse or temperature. These symptoms are very transitory, and recovery is rapid, but the number of these cases is many times that seen in normal periods, and our belief is that these are mild abortive types of the disease, but are also cases which are capable of causing further spread of the infection. It has also been demonstrated in this district and others, that individuals, whilst they are in the incubatory stage, before any symptoms have appeared, are also

capable of spreading the infection. There is not sufficient reason to believe that the virus of Poliomyelitis is conveyed to man by food stuffs including milk, or insects, or that the disease is associated with insanitary conditions. (1) A survey of the homes where cases occurred showed the following classifications as regards sanitary conditions:—Good 45%, Fair 37%, Poor 18%.

SYMPTOMS

A precise and practical conception of poliomyelitis is obtained only by recognizing the existence of three clinically and pathologically distinct stages in its evolution. The picture which will best convey the progress of the disease is *first*, that of a general infection in a sick child or an indisposed adult; *second*, a meningitic invasion, and *third*, in some cases, an extension into the grey matter of the cord, with weakness or paralysis, or localized nervous symptoms. These stages may sometimes be clinically simultaneous, but usually meningeal signs precede evident paralysis.

Initial Stage or Systemic Symptoms. Recognition of this stage is doubly important for the protection of contacts, and for the institution of measures of treatment. It may last only a few hours and be unrecognized, or it may extend to four or more days. The symptoms may simulate any of the indefinite illnesses of childhood, and in the presence of an epidemic of Poliomyelitis, it is well to treat sick children having a fever without a definite diagnosis, as possible cases of Poliomyelitis. Still, there are groups of symptoms which are very suggestive.

Fever is the most common single symptom and may be of any grade. The average temperature amongst our cases was not above 101 and frequently not more than 99.5, but, and this is important, usually accompanied by a pulse rate out of proportion to the temperature. Very seldom was there a rate below 100 and in some cases it ran as high as 160. Average 110-130.

Headache was the next most common symptom occurring in 43 of the cases. Very often it was severe, but in 50% it was recorded as moderate or slight.

Malaise was noticeable in practically every case. The older age groups especially, complain of feeling tired and very weak previous to the onset of more acute symptoms.

Nausea is perhaps the next most persistent finding, occurring in over 60% of the cases, and usually one of the earliest symptoms to be present.

Vomiting, if it occurs, is not usually prolonged, and by many patients is attributed to indiscretions in the diet and not to the disease.

Sore throat was not a major symptom and was recorded in only eight of the cases, although examination of a majority showed a mild injection of the whole posterior pharynx.

Intestinal symptoms are frequent. There may be abdominal cramps and either diarrhoea or constipation. Of this series, ten had diarrhoea while fourteen had constipation.

One of the common symptoms which frequently aid diagnosis in this stage, is *drowsiness*.

The opposite symptom, that of *restlessness* or irritability, was also encountered, sometimes in the same patient. In our series we found 50% had drowsiness, while 35% exhibited restlessness, and in six cases both were found in the same patient.

Two other symptoms which are frequent, and which when present tend to confirm the diagnosis, are *sweating* out of proportion to the air temperature, and *retention of urine*. The latter was noted in about one third of the cases.

Herpes is very rare, although there may be morbilliform rashes appear which at times may be mistaken for other of the exanthemata.

It may be argued that there is nothing distinctive about this clinical picture, that the symptoms enumerated are merely those which may occur in any sick child, and which may pass off without a definite diagnosis being made, but the combination of fever, rapid pulse, headache, drowsiness, irritability, especially when combined with flushing of the face, abnormal sweating or retention of urine is enough to make a tentative diagnosis of Poliomyelitis if there are frank cases occurring in the district. (4) The onset of this systemic stage is frequently insidious. We have histories of eight cases where there was a definite prodromal period of several days before definite symptoms appeared, but it must also be remembered that this stage may pass very rapidly into involvement of the C.N.S., so that closest observation is indicated in every case, no matter how slight the symptoms.

From this stage the condition may clear up rapidly, and complete recovery ensue. But it is equally important to remember that there may be a remission period of some hours or even days, when the temperature falls to normal, and the child appears to have recovered. But this is followed by a secondary rise of temperature and an accentuation of the disease. All too tragically was this phase brought out to us during the epidemic, two deaths and one severe residual paralysis resulting from the mistaken idea on the part of the mother or patient, that this period of remission constituted a cure.

Pre-Paralytic Stage.

Next we come to a consideration of the *Pre-paralytic stage* or the *Meningeal symptoms*. This stage indicates subarachnoid or meningeal invasion. It varies in intensity and duration, but on the whole its duration is short, and it ends either in speedy recovery or passes into the paralytic stage within a few hours.

The greater part of the symptoms already enumerated are continued or renewed, and in addition others make their appearance, chief among which are *pain on spinal flexion*. Pain on forward nodding of the head or especially on forward bending of the lower spine is very frequent and

characteristic. This sign was present in 87% of the Morton cases. Kernigs sign may or may not be present, depending on the degree of meningeal involvement.

Hyperaesthesia is also a symptom attributable to meningitis. The tenderness may be of the skin, on deep pressure of the muscles, or on motions of the joints. The hypersensitiveness may be general in one part of the body only and, if so, often indicates the site of future paralysis.

Loss of sensation was found in some cases, but was a minor feature.

Other phenomena attributed to irritative lesions of the nerve cells are *tremor*, brought out especially if the limbs are extended unsupported or if muscular effort is attempted, and *muscular twitching*, this being present in 40% of the cases.

There is also noticeable lack of co-ordination of motion, which may be noticeable in performing simple motions with the hands, or as an unsteadiness in gait or on standing.

Another noticeable feature of this stage, and one equally difficult to describe, is the *general facial appearance* of the patient. He has what might be termed a definite apprehensive or frightened appearance. The eyes are shiny, almost glassy, and the whole appearance is one indicative of fear or alarm.

Examination of the *reflexes* in this stage also yields valuable information. It is likely to find irregular increases in reflex response, with perhaps some spasticity. We have found some disturbance of reflex in practically every case that has reached this stage. There is usually an exaggerated response for some hours before it passes off into diminution or loss. A unilateral increase or decrease is of more significance than any symmetrical change.

An examination of the *spinal fluid* is undoubtedly of value in this stage, in many cases, and will often serve to clear up an otherwise obscure diagnosis. There is increased pressure, with a clear or nearly clear fluid containing no organisms, and with a cell count of over ten, maybe up to 1,000, with increased albumin and globulin. Without a doubt, if meningeal symptoms are at all pronounced, the procedure of spinal puncture should be followed in order to relieve pressure, and rule out other forms of meningitis. But, in the initial stage previously described, before meningeal symptoms have appeared, the fluid is normal. Our experience has shown us that if the diagnosis can be made in this initial stage, before spinal fluid changes have occurred, that the patient's chances for recovery are greatly enhanced, and even in the second stage of meningeal irritation, a thorough examination of the patient and consideration of the history will, in the usual case, enable a diagnosis to be made as positively without as with a lumbar puncture. (4) We feel, therefore, that where clinical symptoms are definitely suspicious, and where it is not convenient or possible to carry out a lumbar puncture under

proper aseptic precautions, or where facilities are not available for prompt examination of the fluid, that treatment should on no account be delayed due to lack of corroborative spinal fluid findings.

The Paralytic Stage, or stage of invasion of the central nervous system.

The paralysis, when it occurs, is typically flaccid. There may be increased tonicity in the early stages but it never lasts. The paralysis comes on as a rule 4 or 5 days after the initial onset of the disease. Certain muscle groups are much more commonly affected than others, the occurrence of foot drop testifying to the frequent involvement of the lower leg muscles. Of the eight cases paralysed in our series, 3 had paralysis of the right leg, 4 of both legs, and two of these with one arm involved, and 1 had paralysis of the right arm alone. Four of the fatal cases developed an ascending type of paralysis—so called Landry's paralysis, which began in the legs about the 4th day, and rapidly spread upwards involving the sphincters of the bladder and bowel, the arms, the diaphragm, the intercostals, and finally death supervened due to paralysis of the throat. A fatal outcome in three other cases was due to paralysis of the bulbar centers of respiration, so called bulbar or cerebral types, causing difficult swallowing, aphonia, and regurgitation through the nose. In all of these cases, cerebral irritation was a marked feature throughout the entire illness.

DIAGNOSIS

It is evident that the diagnosis of poliomyelitis is not a simple matter, depending on a single factor or sign, but that the whole history and physical examination must be taken into consideration, and when that is done, there are enough idiosyncrasies and predilections of the disease to enable a diagnosis to be made with as great certainty as is usual in the diagnosis of other diseases, without what was formerly considered the essential feature of the malady; permanent paralysis.

TREATMENT WITH SERUM

The administration of the so called convalescent serum prepared by Professor F. C. Cadham at the Provincial Bacteriological Laboratory was used in every case of the 47, with only one exception, and an analysis of the results shows some striking comparisons. Thirty of the cases received serum within 30 hours after initial onset, and of these thirty, twenty-eight have made complete recovery without any sign of residual paralysis. These exceptions are both children who were not kept in bed after the initial symptoms subsided, and a very mild partial paralysis of one leg was noticed only after they had been on their feet for some time. Among the 28 cases which have made rapid and uneventful recovery, are many cases of striking results following the use of serum. Many of these cases, although of short duration, were very acutely ill at the time

of treatment, and without exception there was a rapid loss of symptoms in the 24 hours following, and a marked improvement in the general well being of the patient. Many histories could be cited to exemplify the remarkable change which occurs in these very early cases which receive serum. Nearly all will tell the same story and many will name the very hour at which they began to feel better. There is apparently a latent period of from 8 to 14 hours after administration, before beneficial effects are felt, and the rapid response following that, is perhaps the most satisfactory thing from both the patients and physicians standpoint that I have experienced, excepting perhaps, the lancing of a quinsy in the acute stage.

But there is also the other side to the story, when we begin to consider cases in which the administration of serum was delayed. Four cases received serum 50 to 60 hours after onset, and of these, one died of an ascending type of paralysis, one is permanently crippled in both legs, and for two weeks had paralysis of the bladder and one arm as well, one has paralysis of one leg, and only one made recovery. Seven cases were given serum between 3 and 4 days after onset, with the following results; four died of typical respiratory paralysis within seven days, one has both legs paralyzed, and two recovered. Four other cases were given serum in periods from 4 to 6 days after acute onset. Two are dead and the other two have residual paralysis in both legs. If the cases are classified according to stages of infection when they received the serum, we find the following results:—

Twenty-two received serum in the initial or infectious stage, and twenty-one completely recovered and one has slight partial paralysis of one leg.

Nineteen received serum in the second or meningeal stage (pre-paralytic). Ten recovered, two have residual paralysis, and seven died.

Five received serum in the paralytic stage, and of these one died and the other four still have residual paralysis.

The most noticeable feature of these latter cases, and just as noticeable as the response in the earlier cases, was the almost complete lack of response or disappearance of symptoms following the administration of serum. Of the 14 cases which received serum after 36 hours, only three have recovered without paralysis, which, to my mind, is only additional proof of the virulence of the infecting virus in this epidemic. In five cases, repeated doses of the serum were given failing a response to the first, and there was no noticeable diminution of symptoms at all. It is believed that once the virus has combined with living cells it cannot be neutralized by human serum. Thus, serum is too late to preserve susceptible cells, unless given before the virus-cell union occurs (3).

It has come to be my firm conviction that the reason more universal acceptance and favor for

the serum has not been forthcoming in the literature, is that physicians have waited too long before making a diagnosis, and thus have missed the period during which the serum would have such marked effect. We feel that if one waits for definite symptoms of meningeal involvement such as disturbance of reflexes, marked stiffness or rigidity of the neck, positive spinal fluid findings, muscular twitchings, etc., that there is grave danger of missing the opportunity of saving these patients from possible paralysis or death, and that this factor alone is perhaps more than anything else responsible for the high morbidity and mortality rates which have been the experience in poliomyelitis statistics in the past.

PUBLIC HEALTH ASPECT

One word in conclusion with regard to a public health aspect of the disease. As it appears from our experience at least, that to be of value the serum must be given very early, clearly then that is only possible if the doctor can see his patient early. The public has been notified by the press, by pamphlets, by radio, by local physicians, and by public health nurses, of the importance of calling medical aid at the earliest possible moment. In many cases only the matter of the expense involved has caused parents to delay in calling a doctor, with sometimes, disastrous results. The action of many of the municipalities this fall in granting free treatment to all cases and free diagnosis to all suspicious cases, cannot be too highly commended. It has been the experience in nearly every district where poliomyelitis has occurred this summer, that the first cases were not seen by medical men until paralysis had developed. The institution of this system in the Municipality of Morton in August has resulted in not one case having reached the paralytic stage since that time. In all the areas concerned, the public have been notified by the press and by published notices that such services are available and they are taking full advantage of it. Doctors in these areas report that while they are seeing many cases which do not require treatment, they have yet to find a patient in the advanced stages of poliomyelitis in the first consultation. This association might let us consider this a very forward step in the field of preventive medicine, and only by full co-operation of all parties concerned can effective control of this most dreaded of all infectious diseases be maintained.

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Anterior Poliomyelitis—Manitoba, 1936

By

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The first case of epidemic Poliomyelitis reported in Manitoba this year was from Ochre River on May 2nd, 1936, then during the third

and fourth weeks of June three cases occurred in Morton Municipality. During the following week a case was reported from the Municipality of Grey. The week of July 13th brought in a report from Dufferin and another from the Morton area, and then in a few days the cases began to crop up rapidly in Boissevain and Morton, so that by the middle of August twice as many Poliomyelitis cases were reported from this Municipality as in all the rest of the Province. From this time on the cases in the Morton area rapidly fell off, while in the remainder of the Province a definite increase is noted nearly every week until as Table I shows the week of September 14th reports 46 cases, which so far is the high point, and may be the peak.

The cases have largely been confined to the South Central portion of the Province, but the general direction of the extension from Morton was East and North-East. Each week cases were reported from fresh municipalities, and on August 13th, 1936, the first case was reported in Greater Winnipeg.

Up to date Poliomyelitis has been reported from the following municipalities since June 15th, 1936, and just about equals the cases reported during 1928 outside Winnipeg:—

Assiniboia 1, Boissevain 14, Cartier 1, Brandon 4, Dufferin 1, Gretna 3, Grey 2, Langford 1, Louise 3, Lansdowne 2, Kildonan West 2, Manitou 1, Montclair 1, Morden 2, Morton 30, North Norfolk 1, Neepawa 3, Oakland 2, Pembina 1, Portage la Prairie 3, Riverside 1, Rockwood 2, Roblin Rural 2, Rosedale 2, Selkirk 10, Stanley 8, Strathecona 1, St. Andrews 3, St. Boniface 2, St. James 1, St. Vital 1, Turtle Mountain 3, Unorganized 1, Wawanesa 2, Whitewater 8, Woodworth 8.

TABLE I

ANTERIOR POLIOMYELITIS IN MANITOBA
Reported each week from June 15 to
September 20th, 1936

Week Beginning	Morton Area	Remainder of Province, less Greater Winnipeg	Greater Winnipeg	Total
June 15.....	1			1
22.....	2			2
29.....		1		1
July 6.....				0
13.....	1	1		2
20.....	7			7
27.....	5	5		10
August 3.....	13	2		15
10.....	6	5	2	13
17.....	6	11		17
24.....		10	2	12
31.....	1	9	4	14
September 7..	1	17	10	28
14..	1	24	14	39
	44	85	32	161

Immunity Problems of Poliomyelitis

By

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Poliomyelitis is a disease of paradoxes. It is called infantile paralysis, but infants are comparatively immune and adults are frequently stricken, especially in this epidemic. Some believe the disease is highly infectious, yet only one child of a group or one person in an isolated community may be attacked. It is a disease of the summer months in temperate climates and comparatively rare in the tropics. It kills or paralyzes in a short space of time or leaves the patient apparently unharmed. The immunologic reactions fail to conform to what we would expect of a virus disease.

The immunology of this disease is of such amazing complexity that it would be impossible and of little value at the moment to discuss these difficult and controversial problems.

The infective agent, a virus estimated to be about 0.2 microns in size, has been isolated and cultured and from the culture the disease has been again transmitted, thus fulfilling Koch's postulate. It has been established that the virus enters through the nasopharynx, travels largely if not exclusively by the neural pathways. Acute poliomyelitis involves the grey matter of the spinal cord, the nuclei of the brain stem and the walls of the third ventricle. The prodromal symptoms indicate an initial systemic invasion.

As a rule sudden in onset and as suddenly over, death, paralysis or recovery. What occurs?—is the virus destroyed in the body by similar processes of immunity that occur in other infectious diseases—by leukocytic activity—there is little evidence—by humoral activity—possibly, but if so, it is obvious that the development of antibody immunity needs must be startlingly rapid. Experience shows that in other infectious diseases time is required for the development of antibodies. These fundamental problems of the disease have been subject to an immense amount of experimental work in an attempt to determine or evolve some sound method of prevention or therapy.

TRANSMISSION

How is the virus transmitted? Peculiarly seasonal in incidence, naturally attention is directed to a possible insect vector, but no insect has been incriminated; in fact, epidemics have occurred in localities and at times that would appear to exclude such a type of vector.

The belief is that it is transmitted by healthy human carriers. The virus has been repeatedly recovered from the nasopharynx of persons in normal health. Can we isolate these carriers? At present by no known practical method. Why do not these people succumb to the disease?

Possibly because they have a general immunity or a local tissue immunity of the nasopharynx, or possibly an anatomical mechanical factor is present that prevents the invasion of the virus.

Practical application of the principle involved in the mechanical blocking of the paths of ingress has recently been attempted by applying to the nasopharynx antiseptics that congeal the secretions—picric acid, tannic acid, alum, mercurochrome or alcohol.

IMMUNIZATION

At once, since it is a virus disease, we consider the possible active immunization of the population as practiced to control smallpox. Kolmer has prepared and administered an attenuated vaccine of the virus. Brodie has used a killed culture. Twenty thousand persons are said to have received these vaccines. Nine cases with five deaths occurred in this group, and Dr. Leake of the United States Public Health Service points out that although any one of these cases may have been unconnected with the vaccine, the implication of the series as a whole is clear. At present we must hesitate. I believe, however, that our hope in conquering this dread malady lies in the further improvement of this method.

Failing active immunization, the question of passive immunization arises. Up to the present efforts to immunize animals so that a neutralizing antibody of high titre might be obtained have failed; the virus lacks antigenic value for animals. However, this line of investigation also is of promise.

Finally, we must consider the transference of human serum which is known to contain neutralizing antibodies.

That these neutralizing substances appear in the blood following an attack of poliomyelitis has been abundantly demonstrated. They have also been demonstrated in the blood of over 80% of adults who have no recollection of having suffered from an attack of poliomyelitis and to complicate the question further these neutralizing substances have been found present in horse serum, venom serum and placental extracts.

It is conceived that the persons who have not suffered from the disease but whose blood shows the presence of antibodies have been immunized by a non-symptomatic attack, possibly by an attenuated type of the virus. We have here an analogy to diphtheria—the high protective power of the infant, low antibody content of the blood after one year of age, gradually rising in the general population to adult life; however, in poliomyelitis the problem becomes involved, since persons in whose blood neutralizing substances have been present have been known to contract the disease. Moreover, there are 17 cases on record of a second attack.

It is established that the transfer of human serum is the only practical method of therapy aside from prevention that at present is available.

VALUE OF CONVALESCENT SERUM

The efficacy of convalescent serum in poliomyelitis is the subject of controversy. Park of New York scouted the value as the result of a summary of observations made in the New York epidemic of 1931, even though the statistics of that epidemic indicated less paralysis and a lower death rate in the treated cases; later the New York Academy of Medicine pointed out the untreated group of cases recorded for statistical purposes were a much milder group than the treated group.

Brodie of New York stated he was doubtful if beneficial results were obtained by the experimental method in monkeys, but, as has been pointed out, the results observed in the therapeutic tests of the serum on monkeys does not necessarily postulate that the same would hold for the human type of the disease. On the other hand, Schultz and Gibbard using convalescent serum reduced the death rate in monkeys by 23%. It is of interest to note that while monkeys are highly susceptible to the virus not all are so; the spider monkey of South America appears to be resistant.

Abundant evidence exists that benefit follows the administration of convalescent serum. In the California epidemic, the Manitoba epidemic of 1928, the Michigan epidemic, the Chicago cases and in the Australian epidemic favourable results were noted following the use of convalescent serum. Jensen, describing the extensive epidemic in Denmark of 1935, states "There is a direct and positive justification for the use of serum, in that skilled observers independently again and again have made the clinical observation of a prompt improvement of the general condition of the patient following serum therapy. In a number of cases this improvement was both subjectively and objectively so prompt that the influence of serum was almost unquestionable."

In a recent editorial review of this subject in the *Journal of the American Medical Association* this statement is made—"If future epidemic results can duplicate those mentioned, the treatment of acute poliomyelitis will be satisfactory and harmless to the patient. There is no other treatment that is even of debatable value. The early and continued use of orthopedic measures will improve results in the acute paralytic disease and in cases in which only paresis appears," and Harmon in a recent comprehensive review of the subject of poliomyelitis states "Convalescent and other specific serum therapy should be continued as there is no evidence that it is not of value, on the other hand symptomatic improvement following the administration of the serum is almost universal."

During the past twelve years we have prepared convalescent serum in the Provincial Laboratory; my experience over that period leads me to believe that the treatment is decidedly valuable. Over 1,200 patients have been treated by the serum from the Manitoba Provincial Laboratory and the records of results are uniformly favourable.

It is accepted that the serum is valuable only when administered in the preparalytic stage. Physicians frequently tax me with the question "how can you judge results when the serum is given early, probably the patient may never have had poliomyelitis and the statistics are then misleading, only apparently proving the value of the serum." Strange to say, this factor works in exactly the opposite way. Let me explain. In the epidemics in Manitoba twice the number of vials of serum have been administered as there are cases reported. I estimate of the number of cases treated but unreported some 15% to 20% may not have had poliomyelitis but the other 80% or over had poliomyelitis. A number of these patients showed all the clinical symptoms, including high cell count in the spinal fluid. Sick a day, serum, recovery the next day. Now if the records are taken from the reported cases—and they have been—what then of the other 80% of recovered cases?

I do not believe the serum treatment even in the preparalytic stage is infallible. Far from it. Neither is anti-diphtheritis serum infallible. There probably exists a fulminating type of the infection in which no form of therapy is of avail; then, too, who can determine at what moments the nerve tissue may have been damaged past repair. The element of time appears to be the important factor; early diagnosis, early treatment. The sudden onset and sudden result demonstrate all too clearly the rapidity of the development of immunity, or its failure. In the abrupt battle, if we stimulate the defensive mechanism of the body even slightly, it may be the deciding factor for a fortunate outcome. I am not convinced that the benefit obtained by the use of the convalescent serum depends entirely upon the passive transference of virus neutralizing substances.

ADMINISTRATION OF SERUM

A constant demand arises for the serum for prophylactic purposes. A two weeks' immunity might be so transferred and even that is questionable. Then, too, some physicians do not understand why we cannot keep all supplied with serum to hold in reserve.

Every patient in Manitoba so far as we know in the past 12 years has been able to obtain the serum when necessary and we will endeavour to keep up that record, but I trust that the profession will not take it amiss if I remind them that the serum is not readily come by and it is difficult and expensive to prepare.

I prepare the serum by a different method than is adopted in other centres and have advised the intramuscular route of administration. This advice was based on my experience with the experimental production of antibodies in animals. Howitt of the University of California has since confirmed experimentally the efficiency of this method of administration of convalescent serum in contra-distinction to the intravenous or intrathecal route.

We distribute a pooled serum in vials. The serum is obtained from the blood of selected donors. A Wassermann test is made on each blood. I recommend the administration of the entire contents of the vial. As a rule physicians have limited the amount given to infants. A 20 cc. all glass syringe is required. We also request that once a vial is opened or partly used that the remainder of the contents be discarded.

Experience at the Winnipeg Hospitals for Infectious Diseases

Dougald McIntyre, M.D., Assistant Superintendent of the Winnipeg Hospitals for Infectious Diseases, discussed their experiences with this disease. He stated that they had numerous cases admitted for observation with a provisional diagnosis of poliomyelitis. These were all investigated carefully and a certain proportion were found to be negative and were discharged; all such cases were kept under observation for at least nine days.

The experience with the lumbar puncture had been variable, some had a comparatively low cell count of 20 to 30, and some others had a count as high as 420.

With regard to the clinical aspects of the disease, he stated he had nothing to add to the features which had already been emphasized by the previous speakers.

As a result of their experience he is of the opinion that if the serum is given early, that is, within twelve to twenty-four hours of the onset of symptoms, that the chances of avoiding paralysis are very good. He considers the serum of definite assistance in the treatment of the disease and in fact the only therapeutic agent which is of tangible value in this condition.

Dr. McIntyre suggested that it is very difficult to accurately assess the value of serum therapy and in attempting to do so it must be kept in mind that poliomyelitis like other diseases varies in severity and in its clinical manifestations in different epidemics.

He suggested that the possibility of giving much larger doses of serum might be considered. It is possible he contended that larger doses might be of value in the more serious cases, or in the cases which were seen some considerable time after the onset. Their experiences with other forms of serum therapy, for example in diphtheria, lead him to suppose it might be of value in some cases of poliomyelitis to give much larger doses. He found nothing to intimate that there was any special risk associated with the giving of the serum.

GENERAL DISCUSSION

Gordon Chown, F.R.C.P. (C.), Senior Physician to the Winnipeg Children's Hospital, discussed the question of the increase in cell count in the spinal fluid, which was necessary to confirm the diagnosis of poliomyelitis. He stated he had seen two cases with clinical symptoms which, in his opinion, justified the provisional diagnosis of poliomyelitis and in which the cell count in the spinal fluid after admission to the hospital was 50 cells in one case and 20 cells in the second case. The two cases were brothers and were admitted to hospital September 5th and 7th respectively. These cases had been given the usual dose of serum and in each instance had been classified as suspect poliomyelitis. He was of the opinion that these should be classified as anterior poliomyelitis and recorded as such. He asked Professor Wm. Boyd, the Pathologist, his opinion as to what constituted an abnormal cell count in the spinal fluid of children.

Wm. Boyd, F.R.C.P. (Lond.), Professor of Pathology, University of Manitoba, replying to Dr. Gordon Chown's question, suggested that an increase of cells beyond 10 in a spinal fluid count was abnormal.

F. A. Benner, M.D., stated that it had been intimated there might be some danger in the doing of lumbar punctures. He was of the opinion as a result of his experience that there was no special danger in doing lumbar punctures for diagnosis, and pointed out that in meningitis they were done frequently in some cases, and also intra-theal injections of serum given. He asked if there was any special danger in these cases of which he might not be aware.

Replying to Dr. Benner's question, Dougald McIntyre, M.D., Assistant Superintendent of the King George Isolation Hospital, stated that he did not believe there was any special danger in the doing of lumbar punctures in suspected cases of poliomyelitis, and certainly one was justified in including this investigation in a suspected case during the course of the epidemic. He emphasized, however, that the practitioner should not feel that a diagnosis without a lumbar puncture was impossible. He added that he had seen cases in which the cell count on lumbar puncture had been normal and then, a day later, the cell count in the spinal fluid was definitely increased—in one case it was 80.

Replying to Dr. Gordon Chown, Dr. McIntyre stated that he was of the opinion that there were a great many mild cases with a slight increase in cells in the spinal fluid for example, 20 to 30, which should be classified as poliomyelitis. The diagnosis referred to by Dr. Chown in the two cases was the provisional diagnosis on admission to hospital.

M. S. Loughheed, M.D. (Man.), B.Sc. (Oxon.), Bacteriologist Department of Health, discussed the incidence of the disease in the City of Winnipeg, and pointed out that the greatest increase in the number of cases had occurred within the last few days.

W. W. Musgrove, M.D., asked Professor Cadham to express his opinion as to the value of whole blood in poliomyelitis and the method he would advise in giving it.

Answering Dr. Musgrove's question, Professor Cadham stated that he was of the opinion that if no serum was available that adult whole blood 25 c.c.s. by subcutaneous injections might be of value.

A. A. Murray, F.R.C.S. (C.), discussed the question from the point of view of the orthopedic surgeon. He was interested in the treatment of cases which had developed paralysis. He pointed out that it was essential for the practitioner in attendance to see such cases frequently during the weeks and months immediately following the acute illness. He also pointed out that a group of muscles which might be the weakest in a limb at a particular time should be put at rest by suitable splinting, but that in a comparatively short time another and opposing group of muscles might become relatively weakened. It would then be necessary to adjust the splintage in order to deal with the new situation. He was of the opinion that there were now a sufficient number of cases to warrant that some definite programme should be initiated by the Department of Health looking towards the future care of the indigent patients who are left with permanent partial paralysis. He suggested that it is imperative that this action be taken now because it is much easier, better for the patient and more economical to prevent deformities rather than to correct them.

The question was raised as to the efficiency of the Picric Acid nasal spray as prophylactic against the epidemic of anterior poliomyelitis. Replying to the question of efficiency of the spray, Dr. M. R. Elliott stated that it had been recommended by various medical men who had experience of epidemics in other places. In their own experience it seemed to help prevent the spread of the disease. In one area in which it had been introduced there had been no new cases among children who had been given the full course of prophylactic treatment. There had been two cases where the spray had been used but in both cases the spray had been used only four days and it was presumed that these children had been infected before the use of the spray was started. Dr. Elliott stated that it was too early to form a definite opinion as to the value of the spray but there was sufficient justification as a result of the experience of others and the experience with the present epidemic to recommend its use as prophylactic agent.

F. W. Jackson, D.P.H. (Tor.), Deputy Minister of Health, addressed the meeting briefly and thanked the Winnipeg Medical Society for arranging a symposium on Anterior Poliomyelitis, and suggested that it would be of great value to the medical practitioners and to the Department of Health. He stated that, in his opinion, it was clear, as a result of the experience of his Department with this disease, and as a result of the discussion which had taken place, that control of the disease depended upon early diagnosis and early administration of convalescent serum.

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